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ABSTRACT

Cognetics provides an exciting cooperative learning experience for students that develops both thinking skills and content knowledge. In Cognetics, teams of students in grades 3 to 12 create solutions to problems. This set contains a student manual and a teacher's manual. The teacher's manual explains the concept of cognetics and then provides advice on training students in the following: (1) Problem-Solving Steps; (2) Brainstorming; (3) Solution Inhibitors; (4) Developing Questions; and (5) Practice Activities. Both manuals contain student activities in the following areas: (1) Inventions/Technology problems; and (2) Science Problems. The appendix includes sample challenge questions. (PR)

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THINKING SKILLS ACTIVITIES IN INVENTIONS/ TECHNOLOGY AND SCIENCE

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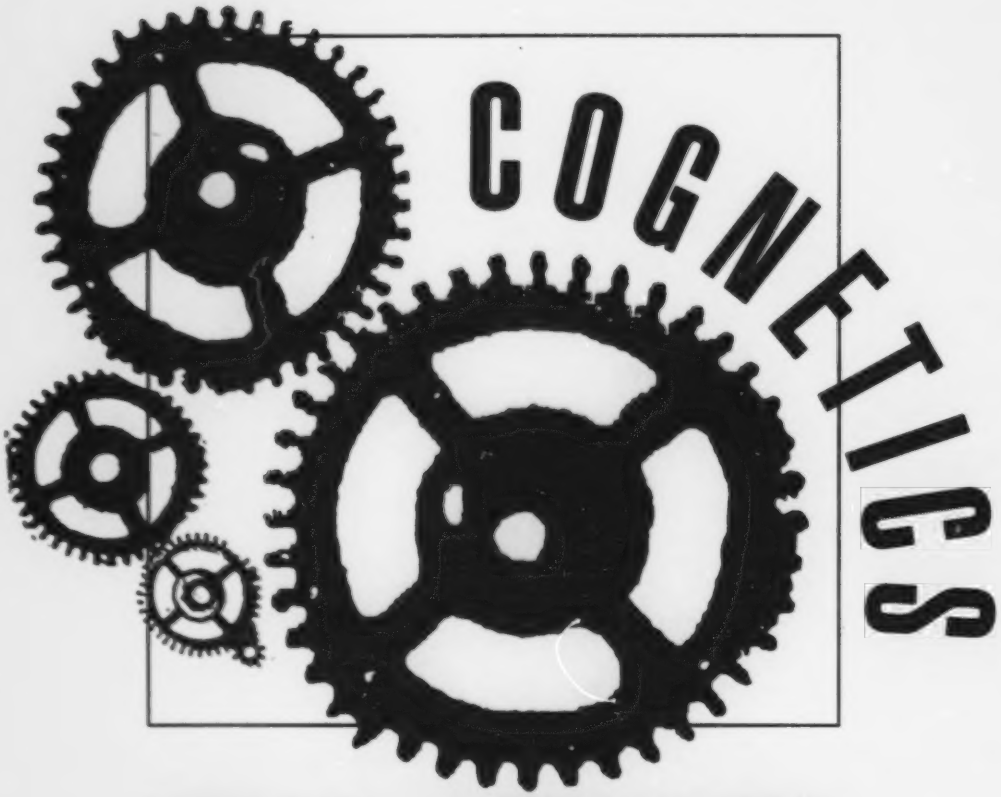

TEACHER'S MANUAL

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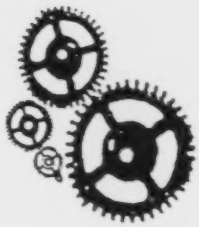

COGNETICS

Thinking Skills Activities in Inventions/Technology and Science

TEACHER'S MANUAL

by

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INTRODUCTION

Cognetics provides an exciting cooperative learning experience for students that develops both thinking skills and content knowledge. This Teacher's Manual contains information to help implement Cognetics in the classroom. The introduction describes the program and how it is used. The next section discusses what students need to know before they can solve Cognetics problems. After that, the manual presents Cognetics problems in inventions/technology and science. References appear at the end of each problem. An appendix contains sample questions which may be used in the "Challenge to the Class" component of the Cognetics problems. Each student should have a copy of the Student Manual, which presents the problems and information needed to solve them.

1. WHAT IS COGNETICS?

Cognetics was originally developed by Dr. Theodore Gourley of the Educational Information and Resource Center (EIRC). It is a non-competitive, research-focused program that requires students to think critically and creatively. The program, which has served thousands of students since 1984, is now part of the National Talent Network operated by EIRC.

In Cognetics, teams of students, grades 3 to 12, create solutions to problems. Teams of five to seven students select a problem, do research to understand basic principles related to the problem solution, and then produce a solution that satisfies problem requirements. In addition to conducting research and team problem solving, presenting the solution to an audience is an important part of the Cognetics process. The presentation shows that the team has worked as a unit and found an appropriate solution to the problem, and gives the team a chance to explain their creative problem-solving process to others. Evaluative scoring directions are included in each problem so that teams can test themselves against what is expected by the authors of the problems. Although students usually enjoy being judged, this part of the process is optional. In any classroom, all teams may tackle the same problem, or different problems may be selected by each team.

This volume includes Cognetics problems selected from those created from 1984 through 1992. The problems are identified as most appropriate to inventions/technology and science curricula; however, most activities develop skills in several curricular areas.

2. HOW DO WE KNOW COGNETICS WORKS?

Cognetics problems have been successfully used with many students since 1984. Over 1,000 students each year, working in teams, have produced solutions to the Cognetics problems. Schools committed to Cognetics have devoted substantial time to working on the problems, with sometimes elaborate results. Students sought out primary resources as they researched their problems and then applied their findings to the world around them. For instance, one problem solution was a child-abuse prevention videotape, which other schools used later. Another problem was solved by developing an extensive beautification program in a disadvantaged rural school. A third team developed a nutritional ice cream cone that had a shelf near the top to catch drippings. This inventive solution received an award from the U.S. Department of Commerce, Patent and Trademark Office. Whether a lot or a little class time is available, Cognetics activities can be productively incorporated in to the curriculum.

In order to arrive at effective, creative solutions, students become actively engaged in the principles they are learning. For instance, in the problem, "Inside Out," students learn how the heart functions, including what causes heart attacks and murmurs, from acting out various functions of the circulation system.

Because Cognetics problems require teamwork, students learn to work cooperatively with each other and form friendships outside their usual circle of friends. From year to year, teachers and students alike enthusiastically report on the benefits of Cognetics experience. Students' work confirms these reports. Each spring, student teams present their solutions at Cognetics Expositions sponsored by the National Talent Network.

3. WHAT IS IN A COGNETICS PROBLEM?

Each Cognetics problem contains:

- An **Introduction** which sets the scene and provides the fictional "background" for the problem. It should be read, along with the problem statement, to the audience before a presentation begins.

- A **Problem Statement** which describes the general tasks to be accomplished in order to solve the problem.

- **Developmental Steps** which detail suggested activities and resources for students to use as they research and prepare their problem solution. These steps require critical thinking to analyze the problem and possible solutions. They also encourage students to add interesting and colorful creative elements to their solutions.

- A **Presentation** section which gives additional instructions on presenting the problem solution. The presentation builds oral communication, as well as creative skills.

- A **Debriefing** section which calls upon students to think about and discuss how they solved the problem, thus fostering higher thinking skills. This section also gives presenters feedback on their ideas from the audience and the judges.

- A **Challenge to the Class** section which asks teams to develop questions about their problem for other students to answer. The teacher determines the number of questions.

- An **Evaluation** which lists the most important aspects of the solution and presentation for which students can receive points if their presentation is judged. Bonus points are given for exceptional originality. In the Cognetics framework, originality is discussed as elaboration on a basic problem solution. Elaboration refers to those things a team can add to their presentation which may not be required, but provide interest and appeal. Sensory, intellectual, and aesthetic are categories of elaboration, which is judged more qualitatively and subjectively than the basic solution criteria. Evaluation judges may be students, teachers, or parents.

- A **Bibliography** which suggests references that students can use as they research the problem. Other materials can be added as well. School, home, and public libraries contain many reference sources on Cognetics topics.

4. HOW CAN COGNETICS FIT INTO THE CURRICULUM?

Instructions on the components above appear in each Cognetics problem. Teachers may select to do sections of problems as they appear or modify them to meet needs and interests. Individual

Cognetics problems can be planned for anywhere from one class period to six or more. The problems do vary somewhat in length. Generally a one-period session could profitably focus on creative thinking stimulated by the problem. Three class periods following this are usually the minimum for completing the major steps: one period for the introduction and problem discussion, the second to carry out the developmental steps, and the third for the presentation. More time can be given to any aspect of a Cognetics problem. For example, developmental steps always include some form of research; this could be minimal or extensive. Also, the presentation is scheduled for only 10 to 15 minutes; more time could easily be devoted to it. Teachers will see many opportunities for adjusting Cognetics problems to their needs, interests, and resources.

Although Cognetics problems could compose a separate course, they were designed primarily to be infused into the existing curriculum. Teachers should incorporate problems into a course according to the content and skills covered in the problem, thus reinforcing units of study. For example, "Just Heavenly" could be used with a space or astronomy unit, while "Strike Notice" or "Commol" could complement a unit in technology or advertising. Cognetics problems also can teach process skills, such as the research process, creative writing, or oral communication.

Two additional approaches to Cognetics problems encourage students to think critically by comparing, contrasting, and looking for general principles. In the first, all teams work on one problem, with each team specializing in variants of the problem theme. This approach makes it possible to compare and contrast findings, which then become the basis for developing a larger understanding of underlying principles. For instance, a class of 15 students using "Atomic Cafeteria" might divide into three teams. Each team would choose its own elements, decide on a compound, and then present its own recipe from the cafeteria. When all the skits have been presented, the whole class could discuss similarities and differences and look for patterns. Discussion would follow about other possibilities and combinations of elements.

The second approach involves each team selecting a different problem with an identified commonality. For example, a number of problems call for producing a videotape. After the presentations, the different kinds of tapes could be examined. What are the similarities and differences? What were the easy and difficult aspects of production? Other process commonalities could likewise be examined and compared, i.e. doing the research, making a model, designing a skit.

When students have found a solution to a Cognetics problem, they should be encouraged to elaborate on their ideas. Adding special features to a problem solution develops creative thinking and results in a more interesting and satisfying product.

5. DO STUDENTS NEED TO BE TRAINED FOR COGNETICS?

Students who are new to cooperative learning and to creative problem solving may not immediately be successful in these approaches. Students need to understand that failure can lead to success, that many unusual ideas help find solutions, and that an idea may take some molding before becoming a practical solution. Solutions to Cognetics problems are intended to be inexpensive, active learning experiences, cooperative social ventures, and FUN.

Many students will find Cognetics problems to be very different from other school experiences. It may be helpful to give them practice activities before embarking on the problems themselves. The next chapter, Student Training, provides information on this.

6. NOTES ON THINKING*

This chapter ends with a few notes on the background philosophy and intent of the Cognetics program.

a. Information vs. Thinking

Traditionally, educators have mistakenly believed that high intelligence is always associated with a high degree of skill in thinking. However, it is not always true that a highly intelligent person, given enough facts, can effectively apply information to solving problems (deBono & Maier, 1983).

Among the many theories of learning are those which relate to information processing. In these theories, thinking is compared to the processes undertaken by a computer. Data are input or read into the computer and the computer outputs, reads out, an answer. Between the input and output, the information is processed through a program which manipulates, analyzes, evaluates, compares, and finally synthesizes the information (Hilgard & Bower, 1981).

Thus, one can compare intelligence and thinking to microcomputers. The computer with 64K has greater memory than a computer with 30K. However, despite the differential in memory capacity, it is the computer with better software which will make better use of stored information. Thinking skills are like the software which allow the computer to make use of stored data or memory. The better the skills, the more useful the mental computer.

b. Thinking Abilities

Memory is but one of the thinking abilities of the human computer, the brain. Several researchers in education and psychology have analyzed the human thinking process and have broken this process down into levels of complexity.

Bloom & Krathwall (1977) developed a taxonomy of thinking skills:

- Knowledge - recalling specific information
- Comprehension - understanding communicated material
- Application - using methods, concepts, principles, and theories in new situations
- Analysis - breaking information down into its constituent parts
- Synthesis - putting together constituent elements to form a whole
- Evaluation - judging the value of materials and methods.

Gilford (1968) presents a more complex analysis. He defines three major areas of the intellect as operations, content, and product. Each of these areas is divided into several subcomponents, which together make up 120 (possible) intellectual abilities. Consider the parallel between Gilford's operations, Bloom's taxonomy, and Cognetics problem-solving steps.

Bloom	**Gilford**	**Cognetics (Problem-Solving Steps)**
Knowledge	Memory	Gather Facts
Comprehension	Cognition	Define Problem
Application/Analysis	Convergent Production	Analyze Problem
Synthesis	Divergent Production	Generate Ideas/Elaborate Ideas
Evaluation	Evaluation	Select Solution/Elaborate Solution

*From Cognetics Manual, T.S. Gourley © 1984.

Regardless of the researcher or the terminology, it is commonly agreed that several different thinking abilities exist. As a Cognetics team works to develop the solution to a problem, each team member must exercise such thinking abilities. The team's coach must be aware of these thinking abilities and the methods to develop them in each team member. The Cognetics problem-solving steps exemplify such methods.

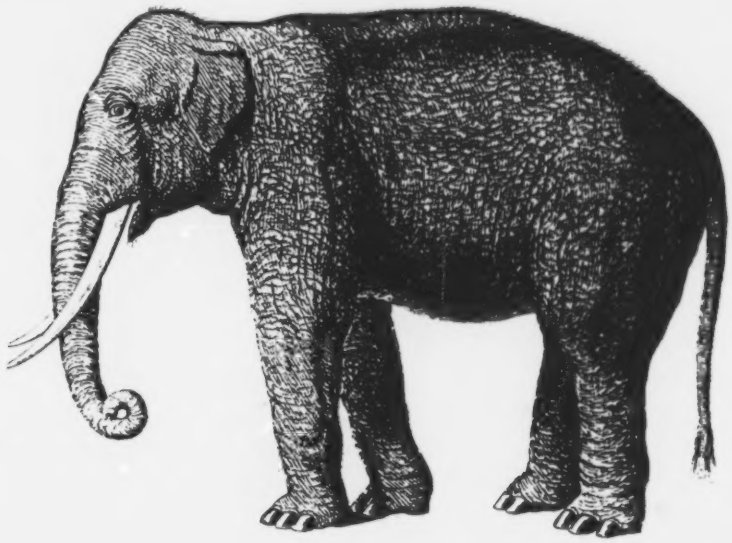
c. Creativity: A Special Thinking Skill

". . . for most of us, creativity is more of a dull glow than a divine spark. And the more fanning it receives, the brighter it will burn" —Adams (1986).

What is creativity? Many people have answered this question. Gowan (1981) extensively reviewed the literature and classified creativity into five theory groups:

- Cognitive, Rational and Semantic
- Personality and Environmental Factors
- Mental Health and Psychological Adjustment
- Psychoanalytic and Neo-psychoanalytic
- Psychedelic

These theory groups have been further expanded for teaching and learning. Some of these implications are discussed in the next section, "Student Training."



STUDENT TRAINING*

Students may need some information and experience to get the most out of Cognetics. Their need could be met with a brief review and discussion of the steps involved in a Cognetics problem, or more extensive training may be helpful. The teacher should make a judgment about students' readiness and proceed accordingly. This section presents training material which may be helpful; it focuses on developing the thinking skills Cognetics calls upon. The sections below cover:

- problem solving
- brainstorming
- solution inhibitors
- developing questions
- practice activities.

This material may also be useful as thinking skills training in general.

1. PROBLEM-SOLVING STEPS

Problem-solving skills are essential to successful work with Cognetics problems. The Developmental Steps are, in fact, steps in the problem-solving process outlined below. Consider this problem:

> *Car X and car Y are in a race toward each other. Car X has a 10 m.p.h. tail wind and car Y a 50 percent downhill grade. Car X is a Japanese make using unleaded fuel; car Y is a Greek roadster using kerosene. After how many hours will they be 500 miles apart? When will car Y reach Chicago? Who was car X's driver's mother? Do you really care about this stupid problem?*

This problem sounds like one out of standardized high school math tests. The effect of such a problem is often to throw the poor problem solver into a panic. Cognetics problems can sound similar to this example. Once students have been introduced to Cognetics problems, the following problem-solving steps give them a systematic procedure for attacking them and other complex problems:

a. Gather the Facts - What is the background for the problem? A mistake many creativity programs make is to ignore the importance of factual information as a basis for the product to be created. Students must gather factual information on the problem.

b. Define the Problem - What is it that the team must do? A common mistake is to read more into a problem than is really required. Give the students the following problem statement:

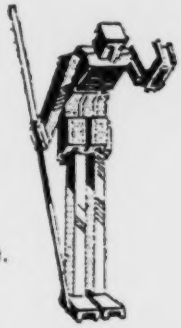
> *Design a robot which will move 10 feet, remove 3 ping pong balls from a box, put the balls into a bag, return to the starting place with the bag of balls, and signal when it is done.*

Now ask the students the following questions about the problem statement:

- Must the robot walk? (no)
- Must the robot pick up the balls? (no)
- Must the robot hold the bag? (no)
- Must the robot talk? (no)

*From Cognetics Manual, T.S. Gourley © 1984.

c. Analyze the Problem - What are the subproblems which must be solved? Return to the robot problem above and ask students to break the problem down into its subparts. They should be able to develop the following list:



- The robot must move a distance of 10 feet.
- The robot must remove 3 ping pong balls from a box.
- The robot must place the ping pong balls into a bag.
- The robot must move 10 feet back to the starting place.
- The robot must transport the bag of balls back to the starting place.
- The robot must signal when finished.

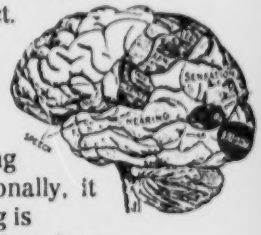
d. Generate Ideas - How might the subproblems listed above be solved? One technique for generating ideas is "brainstorming," which will be discussed later. Have students generate ideas on each of the subparts for the robot problem. For example, how will the robot move a distance of 10 feet?

- roll
- walk
- fly
- be dragged

e. Elaborate Ideas - How might ideas generated actually solve the problem? At this point the ideas will have to be elaborated; i.e., each idea must be discussed in specific detail to determine if it is actually feasible. It is good to develop an atmosphere that encourages group idea elaboration. Brainstorming helps. Allow and encourage everyone to share ideas on ways to make the robot actually roll or fly. As the group tries to elaborate on the ideas, some ideas will soon prove inadequate in that they do not lend themselves to becoming a fully developed solution.

f. Select a Solution - Which of the elaborated ideas will actually solve the problem? Students must develop criteria by which to judge the merits of their ideas. Using these criteria, one idea can be selected for a tryout.

g. Elaborate the Solution - What additional details must or can be added to develop the solution to make its meaning or theme clear, add to its beauty or uniqueness? Students must generate ideas to enhance the solution and develop the solution into a final product.



2. BRAINSTORMING

Brainstorming is an effective technique for generating ideas in the problem-solving process. It is also a technique for developing group problem-solving skills. Additionally, it is a technique for separating "problem finders" from "problem solvers." Brainstorming is especially valuable for Cognetics problems because it requires everyone to be open and to share ideas; brainstorming builds group trust and group problem solving. Brainstorming does not allow for criticism; it discourages "problem finders" from "shooting down" an idea before it has a chance to develop.

In brainstorming, a problem is presented to the group. The group is then asked to generate as many possible solutions as it can within a given time period. One person acts as a recorder and

writes down all the ideas for possible solutions. It is best to write the ideas on a chalkboard, flip chart, or any other device which will be visible to the group. The rules for brainstorming are:

- Anything goes; all ideas are acceptable.
- Judgment is withheld until after the brainstorming time limit has ended—remember, all ideas, no matter how bad, could lead to a good idea.
- Piggy-backing on ideas is encouraged; in other words, anyone can restate or add to an idea which has been presented by another.

Sample brainstorming topics might include: list 1000 uses for a brick; list as many uses as possible for old tires, toothbrushes, paper clips; list ways a robot can signal that the task is completed.

3. SOLUTION INHIBITORS

There are several factors which inhibit the development and expression of ideas. Some of these inhibitors are a function of one's personality; others are a function of the environment, society, or perception. A good teacher should be aware of these inhibitors and counteract them. They are as follows:

a. Fear of Being Wrong - New ideas, inventions, and theories are proposed at the risk of being wrong. Good problem solvers must learn to risk making a mistake. It is said that Thomas Edison's attitude toward an unsuccessful experiment was not that he had failed, but that each time he now knew one more thing that didn't work (Gourley, 1982).

b. Functional Fixedness - We learn that different objects have different uses. A hammer is used to drive a nail, a fork to eat food. However, other objects can serve these functions. A brick, stone, bat, or other hard object can drive a nail. Chopsticks and fingers can replace a fork. Similarly, a hammer can be used as a paper weight. The better one can analyze the properties of an object and the requirements of a problem, the greater one's chances of developing creative uses for the object.

Try this problem with students:

> *Attach a piece of 8½" x 11" paper to the wall (chalk board, etc.) by many different methods. Restrictions: you may not use tape or tacks to solve the problem.*

Note how many solutions are examples of the ability to avoid "functional fixedness."

c. Inappropriate Statement of Problem - The manner in which a problem is stated greatly affects the level of thinking used to develop a solution. Most questions in school are narrowly stated and require simple recall or understanding of previous information. However, a problem stated in broader terms allows greater freedom and depth of thinking. Such broadly stated problems or questions encourage one to create one or more new solutions. Consider the following which involves improving vehicle movement:

> *One group of General Motors engineers was asked "to design a better tire." Another group of engineers was asked "to design a means of transporting a vehicle across a hard, relatively flat surface."*

At the end of 30 minutes, the ideas of each group were evaluated. The group of engineers that tried to solve the "better tire" problem had fewer ideas in both quantity and quality than the group solving the ". . . means of transporting a vehicle . . ." problem. (Gourley, 1976)

Try this problem and others of your own design with your teams. Note that problem statements that include a solution will restrict ideas. A tire is a solution to the vehicle transportation problem.

d. Blocks - James L. Adams (1986) discusses a number of solution inhibitors or "blocks" as he calls them. These blocks include:

1). **Perceptual Blocks** - These are obstacles which prevent the problem solver from clearly perceiving either the problem itself or the information that is necessary to solve the problem. Consider two verbal examples of perceptual blocks.

The Northeastern U.S. word "wasamatawichu" is often not understood as really meaning "What is the matter with you?"

The Southern U.S. word "hiu" is often not understood as really meaning "how are you?"

Perceptual blocks include:

- Difficulty in isolating the problem because of inadequate or misleading information. This is often a result of spending too little effort defining the problem.
- Tendency to delimit the problem area too closely, imposing constraints which really do not exist.
- Inability to see the problem from various viewpoints; this is of special importance when solving problems which involve providing services to others.
- Seeing what you expect to see—stereotyping persons, places, situations, etc., thus blinding oneself to new realities.

2). **Cultural Blocks** - These are obstacles to problem solving which result from exposure to a given set of cultural patterns, including taboos, traditions, social norms.

3). **Environmental Blocks** - These are obstacles which are imposed by the immediate social and physical environment. These include lack of cooperation and trust among colleagues, distractions (phone, noise, people, climate), and lack of support at work and home.

4). **Emotional Blocks** - These are obstacles which our conscious (that portion of the mind which deals with social and moral realities) imposes on our unconscious (ideas, desires, etc.). These include fear of taking a risk, inability to tolerate chaos, need to judge rather than generate ideas (the "problem finder" rather than the "problem solver"), inability to incubate ideas, and/or a preference for reality over fantasy.

5). **Intellectual Blocks** - These are obstacles which result from the lack of ability and/or skill in the use of various mental tactics. The purpose of a thinking skills program such as Cognetics is to develop the thinking skills needed for problem solving.

e. Right Brain vs. Left Brain - Research has focused on the differences between the intellectual functions of the two hemispheres of the brain. The studies indicate that each hemi-

sphere performs its own set of functions. McGee-Cooper (1982) lists the functional characteristics of each side of the brain as follows:

Right Hemisphere	**Left Hemisphere**
Irrational	Rational
Illogical	Logical
Holistic	Linear
Spontaneous	Sequential
Emotional	Factual
Imagining	Knowledgeable
Artistic	Linguistic
Intuitive	Systematic
Spatial thinking	Symbolic
People-oriented	Fact-oriented
Impulsive	Planful
Creative	Implementing
Visual thinking	Thinking in words and figures
Playful	Serious
3-D thinking	2-D thinking

A closer look at the functions of each hemisphere reveals that they appear to be in conflict. This conflict is probably cultural rather than natural (Devereux, 1969). The left hemisphere represents what Adams (1986) identifies as cultural and emotional blocks to problem solving and what Freud (Finch, 1960) identifies as restrictions of the ego (social awareness) and superego (morality) upon the id (the instinctive subconscious).

However, the authors' position is that these two hemispheres are not in conflict, but represent different intellectual functions and strategies for problem solving. Sometimes we need to dream and sometimes we need to plan. The two are not opposite, but represent different stages along the same path. Ideas come when one relaxes and dreams. Dreams become realities when one plans and works. Without the dreams, there would be nothing to plan for and without the plans, dreams would never come true. Thus, when preparing a team or class to solve a problem, attention must be given to developing both hemispheres.

4. DEVELOPING QUESTIONS

Skill in designing questions is crucial as the basis for the Challenge component of Cognetics and because they involve key thinking skills. Two aspects of question development are the focus here.

- What is the thinking process for creating a question?
- What thinking abilities are required to answer different types of questions?

a. Question-Creating Steps

Five steps are recommended for creating questions.

1.) Understand the Criteria - What is the purpose of the question? The purpose can include:

- Determine basic knowledge.
- Identify most knowledgeable students.
- Review important facts.
- Apply knowledge to new situations.

Example: one criterion is to apply knowledge of history to a current situation. This criterion might be used to develop a question for a course on 20th century U.S. history.

2.) Review Facts - What is the body of information from which questions can be drawn? The body of information can include:

- textbooks, class lectures
- personal experience
- knowledge of resources.

3.) Apply the Criterion - How does the body of knowledge relate to the purpose of the question? A determination is made on the facts which meet the criteria.

Example: economic inflation-depression cycle, entangling alliance, dictatorial control-revolution-dictatorial control, etc.

4.) Select Facts - What is the specific information to be tested? From those facts which meet the criteria, a specific fact is selected for question development.

Example: entangling alliances.

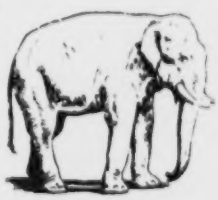
5.) Design Question - What is the statement which relates selected facts to the purpose of the question? The criterion asks not just for repeating factual information, but drawing a conclusion by applying information from one situation to another.

Example: Relate the entangling alliance which existed prior to World Wars I and II with our current European, Asian, and American alliances with regard to a possible World War III.

There are direct parallels between Gilford's operations, Bloom's taxonomy, Cognetics problem-solving, and Cognetics question-creating steps:

Bloom	**Cognetics Problem Solving**
Knowledge	Gather Facts
Comprehension	Define Problem
Analysis/Application	Analyze Problem
Synthesis	Generate Ideas/Elaborate Ideas
Evaluation	Select Solution/Elaborate Solution

Gilford	**Cognetics Question Creating**
Memory	Review Facts
Cognition	Understand Criteria
Convergent Production	Apply Criteria
Divergent Production	Select Facts
Evaluation	Design Question



Therefore, when teaching students to create a question, use the following sequence: understand criteria, review facts, apply criteria, select facts, and design question. When teaching students any step in the sequence, use techniques designed to develop parallel concepts in the matrix above.

Example: techniques used to develop "Knowledge, Memory, or Gathering Facts" can also be used to teach "Review Facts."

b. Question Answering

The manner in which a question is phrased—question statement—controls the type of thinking skills required to produce an answer. Most school activities and tests involve narrow questions concerned with single, correct answers. Using Bloom's taxonomy, narrow questions, would be those involving knowledge and comprehension. Such questions require:

- KNOWLEDGE: define, describe, distinguish, list, show, tell, name, recall, recognize.
- COMPREHENSION: predict, reorder, explain, illustrate, compare, conclude, extend.

Broad questions permit a variety of responses and require higher levels of thinking. Such questions are used to explore subjects and stimulate interests rather than verify facts and review material. Using Bloom's taxonomy, broad questions would be those involving application, analysis, synthesis, and evaluation. Such questions require:

- APPLICATION: apply, develop, test, build, plan, solve, demonstrate, indicate.
- ANALYSIS: analyze, categorize, relate, explain.
- SYNTHESIS: write, create, propose, formulate, derive.
- EVALUATION: evaluate, decide, judge, choose, defend, select, check.

The following are sample questions which exemplify the levels of thinking skills (McDonnel, 1984).

1.) Topic: Nutrition

- Knowledge: Name three of the four food groups.
- Comprehension: What is the role of proteins in good health?
- Application: Make a meal plan using the four food groups.
- Analysis: Compare the human diet to the diet of an animal.
- Synthesis: Develop an advertisement for a food that builds healthy bodies.
- Evaluation: Do you think the government's control of food substances has been beneficial?

2.) Topic: Astronomy

- Knowledge: How many planets are there?
- Comprehension: How does the sun influence people on earth?
- Application: In visual form, show the interrelationship between the sun and the planets.
- Analysis: Compare a galaxy and a quasar.
- Synthesis: Design a space suit appropriate for exploring Mars.
- Evaluation: Should the U.S. explore space?

3.) Topic: Kenya

- Knowledge: What is the capital of Kenya?
- Comprehension: How do the Kenyans control the wild animals?
- Application: In visual form, show the sources of economic support in Kenya.
- Analysis: What do you think will be the major problem facing Kenya 20 years from now?
- Synthesis: Generate a plan for developing social services for Kenya.
- Evaluation: Do you think Kenya's economic policy is a good one?

5. PRACTICE ACTIVITIES

These first activities are designed to develop students' general ability in each of the Cognetics problem-solving steps. Later, two subject-specific activities are presented.

a. Gather Facts

A number of activities can be conducted to improve a student's fact-gathering skill. These activities should build the student's ability to use a variety of fact-gathering resources.

- **Books** - Students should look up information, places, dates, definitions. They should be able to use textbooks, periodicals, reference books, dictionaries. Plan a trip to the library and ask the librarian to review the various sources of information available there. Send students to the library to find information from various resources. Have them find the current largest export of Ireland, interesting facts about Edison's childhood, the flag of Italy, a list of the kings of England, etc.

- **People** - Individuals who are experts in various fields are excellent sources of information. These resources represent volumes of printed material. The information is there for the asking. Train students in interviewing. Have them interview for specific information and practice personal face-to-face and phone interviews.

- **Observations** - Information is available through the senses: sight, hearing, taste, touch, and smell. The sharper one's senses, the more information available.

Have students practice activities to sharpen their senses.

- Show students a picture with numerous details for 10 seconds. Then have them answer questions about the picture.

- Prepare recordings of common sounds. Play the recordings and ask students to identify the sounds.

- Ask students to close their eyes; then pass around common objects for them to identify by touch. Collect the objects and ask the group to name the objects they touched.

- Use common objects from the home, school, or yard and have students close their eyes and identify the objects by smell.

b. Define the Problem

A number of activities can be conducted to help students define the problem. Developing this ability will increase the understanding of what actually is required by the problem and what is necessary.

- Develop problem statements for common objects. For example, a hammer could evolve from the following problem statement.

  Design a light-weight, portable device which can be used many times to drive a nail into a board.

- What is the key phrase in this example? (device . . . to drive a nail)

- Have the students develop problem statements for a number of common objects such as glass, pencil, screwdriver, lamp, chair.

- What is the key phrase in each problem statement?

c. Analyze the Problem

A number of activities can be conducted to help students develop the ability to analyze the problem. This skill will enable them to understand specific requirements and identify important information.

- Analyze the problem statement for a hammer. What are the specific requirements (light weight, portable, used many times over, drives nails).

- Change one of the specific requirements (other than the key statement "drives nails"). How might this change the product used to drive nails? What might this product be?

d. Generate Ideas

A number of activities can be conducted to help students generate ideas. While the creative flash could take place at any step, it is at this point that one would most expect to find the "aha." Therefore, unusual and original ideas are especially welcome. Brainstorming is an excellent tool to generate ideas.

- "What if?" statements can be created and answered.

  What if Christmas came in August?
  What if ice didn't melt?
  What if all grassy surfaces were covered with astroturf?

- Alex Osborn (1963) in **Applied Imagination** uses a checklist in order to develop new ideas. Have students apply the following to any subject, a ball for example:

  Put it to other uses.
  Adapt it.
  Modify it.
  Magnify it.
  Minify it.
  Substitute it.
  Rearrange it.
  Reverse it.
  Combine it.

e. Elaborate on Ideas

A number of activities can help students elaborate on generated ideas. Developing this ability will prevent the individual or group from rejecting potentially good ideas.

Thinking out loud is a good example. Have students consider each idea one at a time for a given time period (if the list of generated ideas is too long, pre-selecting ideas may be necessary). Encourage everyone to just "think out loud" about the idea. At the end of the time period, if the group is unable to elaborate on the idea, the idea should be rejected.

f. Select Solution

A number of activities can develop students' ability to select a solution. These activities involve evaluation or decisionmaking skills.

- For example, give them the following problem:

You have $25 to spend. Think of a number of things to spend it on. Then choose those things to spend your money on which meet the following criteria:

It is safe.
It is fun.
It is useful to others.
It can be enjoyed again without additional cost.

Explain how your choice meets the criteria (adapted from Talents Unlimited).

- Have students develop criteria for:

choosing a vacation;
buying an ice cream sundae;
being sick enough to stay home from school;
being well enough to go out and play.

g. Elaborate on the Solution

A number of activities can develop students' ability to elaborate on a solution. Developing this ability will ensure that good, creative ideas will be carried out to completion. This involves planning in detail.

Provide students with the basic steps in planning. First, they must understand what it is that they wish to do. Second, they list all the things they will need. Third, they list all the steps in sequence. Finally, they list all the problems they may encounter (adapted from Talents Unlimited).

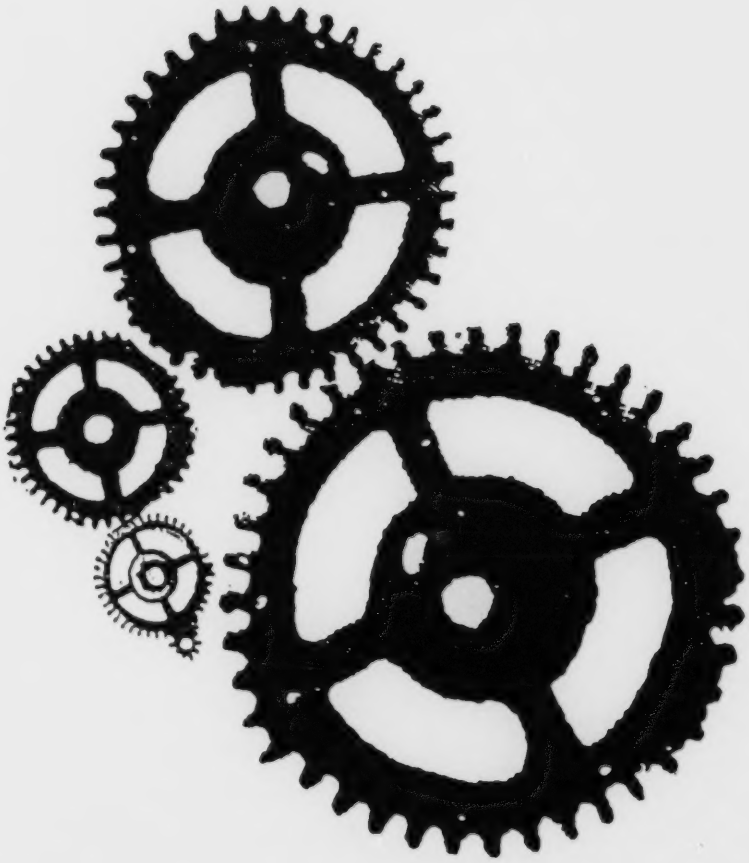
Plan to make and eat a peanut butter and jelly sandwich.
Plan a family picnic.
Plan to clean the yard.

Two final activities are designed to increase knowledge and understanding within a specific subject by applying the problem-solving process to problems which are content specific.

History- *After studying the growth of human civilization, try a cross-cultural analysis problem. Students working individually or in small groups are to design artifacts of an imaginary nation which combine characteristics from two of the cultures studied (example - Celtic and Roman). The artifacts will illustrate the religion, economics, architecture, literature (folklore), and politics (government) of the imaginary nation. The artifacts will be presented to the rest of the class. The other students must then analyze the artifacts to determine which two civilizations from those studied were combined to form the new nation.*

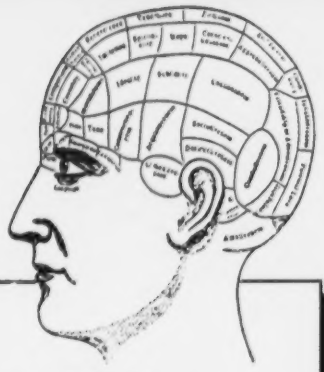
Creative Writing- *"Soap Operas" rely on the ability of writers to create new characters and events which suddenly and dramatically change the story line, thus creating mystery and interest. Have students create a setting and basic characters. Now, for a soap opera, develop a story line that changes five times through the introduction of new characters and/or events. The new characters and/or events are to be described in detail. This could be a group or individual writing project.*

Inventions/Technology Problems



COMMOL

BY THEODORE J. GOURLEY



Introduction

Dr. Lesly Tenthse, the director of research and development of the Neuro-Psychological Institute at the State University, has recently announced a discovery which could greatly reduce anxiety, depression, and many of the mental and physical "diseases" which are stress-related. The research was conducted under a grant from Mer-Ker Jones Corporation. That corporation is now preparing to sell a new product based on Dr. Tenthse's discovery. This new product will be called Commol, and 25% of the profits from its sales will go to fund further research at the Neuro-Psychological Institute. You and your colleagues work in marketing and advertising for the Mer-Ker Jones Corporation. It is your responsibility to design the advertising for this new product.

PROBLEM STATEMENT

Design and produce the print and broadcast materials to sell Commol, a new product to reduce stress. The materials to be designed and produced are a 60-second videotaped T.V. commercial*, a 30-second audiotape for a radio commercial, a 150-word press release, and an 8½" by 11" magazine advertisement.

DEVELOPMENTAL STEPS

1. Study the effect of stress on physical and mental health. Find out which diseases are associated with stress.
2. Create your product, Commol. What is it? What effects does it have? How is it used? Why does it work?
3. Obtain and study press releases. How are they written, what tense, what person, etc? What needs to be included in a press release? Develop a 150-word press release on your product.
4. Study ads in magazines to decide which are more appealing for Commol: drawings, photos, slogans, etc. Talk to artists, writers, and photographers who have worked on ads. Develop an 8½" by 11" advertisement for a magazine.
5. Obtain technical help from someone who is experienced in making audio and videotapes. This individual should teach the team how to produce their own tapes for Cognetics, not produce the tapes for them.
6. Record and study radio commercials. What elements would be most appropriate for Commol? Develop a 30-second commercial for radio. The commercial is to have:
    - background music
    - sound effects
    - dialogue.

* If video equipment is not available, a skit may be substituted.

7. Develop a 60-second videotape to be used for a T.V. commercial. (If video equipment is not available, a live skit may be substituted.) The commercial must:
    - have an original jingle (words and/or music)
    - show the product
    - describe how the product is to be used
    - make it clear what the product is (i.e., pill, food, place, etc.)
    - make it clear what the product does (i.e., its effects upon the user).

8. Develop the elaboration necessary to make this a unique, creative production.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. The team should present copies of the press release and the magazine ad to the judges.
3. The team should then present the radio commercial. (Two presentations may be necessary to allow the judges adequate time to evaluate it.)
4. Then, the team should present its television commercial. (Two showings may be necessary.)
5. Finally, a team spokesperson should read the press release and show and describe the magazine advertisement to the audience.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions which require naming those diseases which are believed to be stress-related.

EXAMPLE: An example of a stress-related disease is _____ .
a. mumps
b. measles
c. hives
d. pneumonia

ANSWER: c. hives

Intermediate: Teams prepare and ask questions about the relationship between stress and certain diseases. The questions should be written as analogies.

EXAMPLE: Bacteria is to infection as _____ is to an ulcer.

a. garlic
b. divorce
c. milk
d. promotion

ANSWER: b. divorce

Advanced: Teams prepare and ask questions about the relationship between stress and certain diseases. The questions should be written as riddles.

EXAMPLE: I come with butterflies.
I leave with knots.
I'm the subject of song—
But the problems I cause
When things go wrong!
Who am I? What do I cause?

ANSWER: Love causes anxiety.

EVALUATION

Points Received		Possible Points
____	1. The team has designed a press release.	15
____	2. The team has designed a magazine ad.	15
	3. The team has produced a radio commercial.	
____	• The commercial has background music.	5
____	• The commercial has sound effects.	5
____	• The commercial has dialogue.	5
	4. The team has produced a T.V. commercial.	
____	• The commercial has an original jingle.	5
____	• The commercial shows the product.	5
____	• The commercial describes product's use.	5
____	• The commercial clarifies nature of product (pill, food, etc.).	5
____	• The commercial clarifies effects of product on user.	5
____	5. Debriefing showed understanding of the problem and solution process.	10
____	6. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	7. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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CONTRAPTION

BY ELVIRA R. BROWN

Introduction

There are those who wonder so much about what makes things tick that they will take apart a watch to examine its gears. Then there are those who only wonder if their watch has the correct time.

A native of New Hampshire once explained the custom of people in his region to "walk a look." A person would look as far out on the horizon as possible, pinpoint some spot, then walk there, enjoying the beauty of all that could be seen during the journey.

As we allow ourselves to wonder, we are mentally "walking a look." In the process, we discover many things. It was in the year 1550 that the Italian mathematician Geronimo Cardano used his mind to walk a little further than "a look." He saw a solution for which there wasn't even a problem yet. It wasn't until 275 years later, when people were searching for a means of transferring power from a steam engine to the wheels of a carriage that the Cardano coupling, now known as the universal joint, was first used.

PROBLEM STATEMENT

Design a solution to a problem of the far-off future, then build a working contraption and demonstrate its use. Incorporate the use of gears, a pulley, and a lever and fulcrum. Then, design a trade symbol or logo for the contraption and three visual applications of the symbol. Develop a presentation of your creations.

DEVELOPMENTAL STEPS

1. Examine gears, pulleys, and levers that are used in common contraptions, such as bicycles, industrial mills, cars, toys. Learn how they function and relate to one another.
2. Look up the word "prototype." Your team will be responsible for making a working machine that actually performs a function. For example, if you are making a futuristic popcorn popper, your contraption should actually produce popped corn.
3. Identify possible problems of the future. A good way to track your thinking as you "walk further than a look" is to record all ideas on a future's wheel. For instance, write down a problem idea, then link in diagram form the many different and unusual effects that may result from the problems.
4. Select a problem and design a contraption that will solve it. For example, a way to solve the garbage problem might be to develop a trash can fitted with its own compactor, incinerator, and air filter so that, from start to finish, the trash is contained, processed, and released in a harmless form. The contraption should be drawn on blueprint, with all parts clearly labeled.
5. Build a working model of the contraption, using gears, a pulley, and a lever and fulcrum.

   NOTE: As with all Cognetics solutions no open flames, caustic chemicals, or otherwise potentially hazardous materials may be used.
6. In order to successfully market the product, team members need to advertize the contraption. Design a trade symbol or logo which describes either the activity (e.g., agriculture), production

site (e.g., spinning wheel), product (e.g., hats), holiday or festive occasion (e.g., weddings). Then, design visual examples of the use of the symbol or logo for three of the following five:

- announcement
- advertisement
- trade card or menu
- envelope
- business form.

7. Develop and practice a presentation of your contraption and advertising. The presentation should be in skit form; costumes and props may be used.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and cleanup.
2. A team member should describe the future problem which needs to be solved.
3. The contraption should be displayed to the audience. One member should act as the "Cardano" of the group, using the blueprint to explain the contraption with all its parts (gears, pulley, etc.).
4. Then, some members should represent the people in the future who build the first practical application of the solution.These members will demonstrate the contraption, explaining how the gears, pulley and lever function together to make the product work.
5. Finally, one member should give a marketing pitch, explaining the relationship of the trade symbol and applications to the contraption.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about machines.

EXAMPLE: A bar for raising a weight at one end by pushing down at the other end is a _____.

a. force
b. lever
c. fulcrum
d. gear

ANSWER: b. lever

Intermediate: Teams prepare and ask questions about the relationship between a machine and its parts. The questions should be written as analogies.

EXAMPLE: A _____ is to a mechanical clock as the quartz crystal is to a quartz clock.
a. pendulum
b. sundial
c. winding key
d. spring

ANSWER: a. pendulum (The vibrations of both control the speed of the clocks.)

Advanced: Teams prepare and ask questions about the relationship between a machine part and its function. The questions should be written as riddles.

EXAMPLE: I'm a study in contradiction,
But not a work of fiction.
Covered in grease
To keep me clean.
Right in a face,
But never seen.
I bite, but don't swallow—
Are you beginning to follow?
What am I?

ANSWER: gear

(SEE FOLLOWING PAGE FOR EVALUATION AND BIBLIOGRAPHY.)

EVALUATION

Points Received		Possible Points
____	1. A possible problem of the future was identified.	15
____	2. A blueprint was displayed and explained with all parts clearly labeled.	20
	3. A contraption was demonstrated with explanation of how parts function. The contraption:	
____	• uses gears	5
____	• uses pulley	5
____	• uses lever and fulcrum	5
____	• works.	5
	4. Packaging and logo were displayed and relationship to the product is explained. Visuals were presented for *three* of the following (5 points for each visual **up to 15**):	
____	• announcement	5
____	• advertisement	5
____	• trade card or menu	5
____	• envelope	5
____	• business form	5
____	5. Debriefing showed understanding of the problem and solution process.	10
____	6. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	7. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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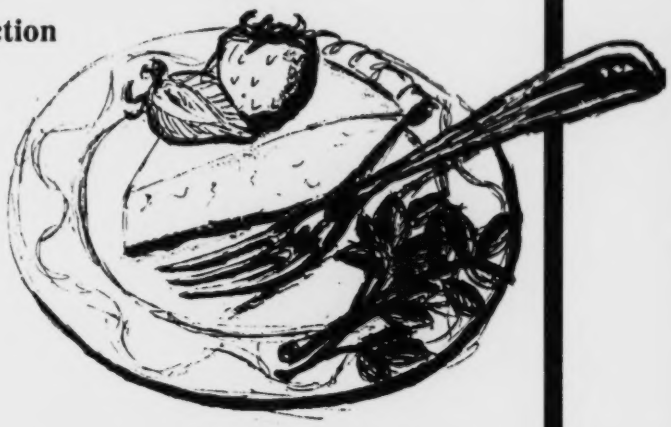
FEED ME

BY JUDITH E. BURR

Introduction



The meat won't cut.
The soup will drip.
The milk will spill.
Spaghetti slips.
The ice cream melts,
Right down your hand.
And those adults—
They think it's grand
To have a knife and fork and cup
And spoon and bowl
From which to sup.

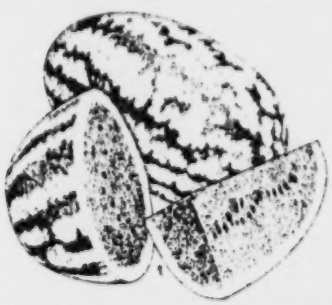
Yes, indeed, getting food from table to mouth can be a real challenge when you're limited to traditional American utensils and tableware. Not only do you end up wearing food, or burned, or frozen by it, but you run the risk of starvation, with half your meal falling to the floor.

PROBLEM STATEMENT

Design a better way to consume food or drink that does not involve a standard knife, fork, spoon, glass, bowl, or plate; is safe to use regardless of the food's temperature; allows the diner to "capture" the food or drink effectively; excludes the direct use of fingers as a utensil. Then, develop a skit in which a diner demonstrates the use of the new method.

DEVELOPMENTAL STEPS

1. Discuss the problems a person might have when eating or drinking at home, school, a restaurant, or a special event (party, ballfield, beach, etc.).
2. Review the list of foods and drinks below. What are some potential problems with consuming each? What problem foods or drinks would you add to this list?



FOOD AND DRINK LIST

honey	watermelon
butter	ice cream
hot soup	fried eggs
spaghetti	salad with dressing
noodles	ketchup
oranges	Kool-Aid (from a pitcher)
chicken legs	drink with crushed ice
steak	peas

3. Bring in samples of cutlery, tableware, and food or drink containers from home and examine their variations. What difficulties in getting food or drink from table to mouth were their manufacturers trying to prevent?

4. Read about different eating customs in today's cultures, and how these customs have changed throughout history.
5. Pick one item from the "Food and Drink List" and discuss the problems that arise when trying to consume this item.
6. Develop a method for getting your chosen item from table to mouth. The method should solve the problem or problems you have already identified. Give your method a name. The method should not use standard utensils in a traditional way or fingers as utensils, should be safe, and should capture food effectively.
7. Develop and practice a short skit in which a diner and whatever additional characters (team members) you invent will describe to the audience the problems traditionally encountered when trying to consume the chosen food or drink. Then demonstrate the solution, using the actual food or drink. Remember to include features that will make your solution colorful, interesting, and unique.
8. Plan to invite a member of the audience to use your method as part of the skit. Be creative in the role you ask the person play.

PRESENTATION

1. The team has 10 to 15 minutes for set up, presentation, and clean-up.
2. The team should present the skit, featuring a diner and other characters, to describe the problems traditionally encountered in consuming the chosen food, and to demonstrate the problem solution.
3. The team should then select a member of the audience to play the diner or another role.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about specific cutlery, tableware, or containers and their functions.

EXAMPLE: A finger bowl is a _____.

a. tiny dish the width of a finger in which expensive cooking spices are kept
b. long, narrow dish shaped roughly like a finger
c. basin to hold water for rinsing fingers at the table
d. bowl from the Finger Lakes

ANSWER: c. basin to hold water for rinsing fingers at the table

Intermediate: Teams prepare and ask questions concerning parallel utensils in different cultures, or utensils performing the same function over time. These questions should be written as analogies.

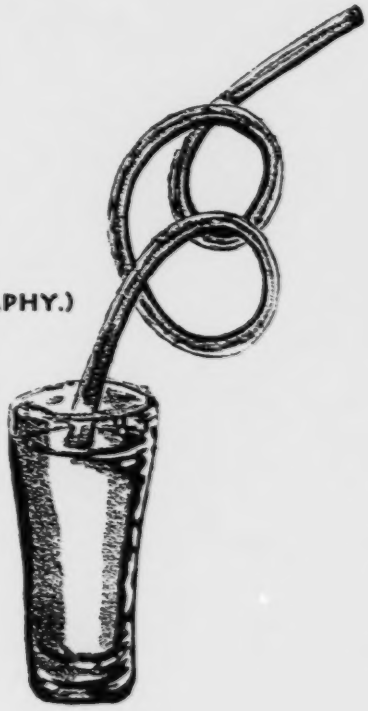
EXAMPLE: Fingerbowls are to the 19th century as _____ are to the 20th century.
a. fingerfoods
b. paper napkins
c. moist towelettes
d. spice racks

ANSWER: c. moist towelettes

Advanced: Teams prepare and ask questions regarding specific cutlery, tableware, or containers and their functions. The questions should be written as riddles.

EXAMPLE: I pull food up;
I slide it down.
I'm long and thin,
But also round.
I do like liquids,
Pieces, too,
But they must be too small to chew.
I'm fun to use.
Can you guess who?

ANSWER: a drinking straw



(SEE FOLLOWING PAGE FOR EVALUATION AND BIBLIOGRAPHY.)

EVALUATION

Points Received		Possible Points
____	1. A food or drink item was chosen from the list.	10
____	2. A better way to consume the item was designed; this method:	
____	• does not use a standard utensil	10
____	• is safe to use	10
____	• is effective	10
____	• does not use fingers as a utensil.	10
	3. The new method was presented in a skit which:	
____	• described the problems traditionally encountered	10
____	• demonstrated the solution.	10
____	4. Debriefing showed understanding of the problem and solution process.	10
____	5. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	6. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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IT'S IN THE MAIL

BY ELVIRA BROWN

Introduction

In our day of express mail, next-day service, and front-door delivery of parcels, we have come to take the mail service for granted. In the Pony Express days, people never thought airmail possible; it was something for science fiction books.

Come with us to the future, to the year 2087, when "airmail" really means airmail. Mrs. J-X14 is once again on the video-phone trying to explain what happened to the 2000 MPH Zoom payment that she recently mailed.

Your mission, should you choose to accept it, is to devise a means of getting mail to its destination almost immediately. Remember that there are a variety of things that could cause any piece of mail to be delayed. Include some kind of fail-safe measures to ensure delivery.

PROBLEM STATEMENT

Design a way to transport objects from one location to another through thin air at great speeds and with total accuracy, and present your solution in a skit. Your future mail system should transport objects through the air, suggest a post office of the future, and include a fail-safe system that can catch an article that is in danger of being lost in the mailing process.

DEVELOPMENTAL STEPS

1. Trace the origin of mail delivery in this country starting with the Pony Express days. Identify unsung heroes (people) and depots (places) of the past.
2. Explore the period of railroad development when East literally met West. Also, investigate the beginnings of air and sea travel and their adaptations for commercial cargo. These will lead you to the mail system that developed as a result of technology. Then consider other advances in technology that might usher in a future era of postal delivery.
3. Interview employees of your local post office. Visit a service center that ships at great speeds such as UPS, Express Mail Service, Federal Express.
4. Examine the methods used to safeguard property while transporting large quantities of it. Learn about registering mail, requesting return receipts, and having armored guards ride with the mail.
5. Visit a drive-in bank that has remote windows and explore the system of sending objects, up, over, and down chutes. While you're examining how parcels travel, consider also how nature transports seed pods, such as the maple tree seeds that flutter overhead, fly horizontally, and land far away from their original point of departure.
6. Find out what happens to mail that cannot be delivered. Look for obscure facts about messages that were delivered against all odds—notes in bottles that reached distant shores, 50-year-old waylaid letters. . . .

7. Design and construct an airmail system which:
    - can be used by any member of the public
    - can transport mail from the size of a post card to a manila envelope weighing up to 6 oz.
    - activates signals in 4 different locations to show where the mail is in the system
    - has at least one airmail link, where mail is transported, or appears to be transported between 2 points through the air.
8. Draw a schematic or blueprint of your airmail system.
9. Make your post office real by filling it in with details—set, costumes, props, and write a skit to demonstrate how it would be used on a particular day. Remember to include special features that will make your presentation colorful, interesting, and unique.

PRESENTATION

1. Each team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. The team should present their schematic or blueprint to the judges and explain it to the audience, i.e., how the system should work.
3. The team should then demonstrate the system via their skit.
4. After one successful run, an audience member should be selected to test the mail system.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about technology and communication.

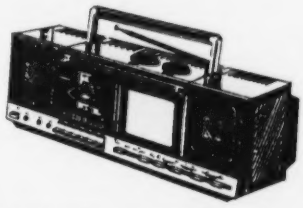
EXAMPLE: Letters going to the following country may be sent by airplane for fast service or by underwater pipelines for less expensive service.

a. England
b. Germany
c. Denmark
d. None of the above

ANSWER: d. None of the above (Underwater pipelines have not been developed for mail service.)

Intermediate: Teams prepare and ask questions regarding the relationship between technology and communication. The questions should be written as analogies.

EXAMPLE: Radio is to sound, as _____ is to picture.
a. wireless
b. satellite
c. T.V.
d. stereo



ANSWER: c. T.V.

Advanced: Teams prepare and ask questions about specific technology and communication. The questions should be written as riddles.

EXAMPLE: I get my start from earth, wind, and fire.
My message is for all to see—
The eagles of the air,
The buffalo of the plains.
Yet few understand.
What am I?

ANSWER: smoke signals

EVALUATION

Points Received		Possible Points
____	1. A mail system schematic or blueprint was presented and described.	10
	2. An airmail system was demonstrated which:	
____	• can be used by any member of the public	15
____	• can transport mail from the size of a postcard to a manila envelope	15
____	• has signals that can be activated in 4 different locations to show where mail is in the system	15
____	• has at least one link where mail is transported, or appears to be transported, through the air.	15
____	3. Debriefing showed understanding of the problem and solution process.	10
____	4. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	5. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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OOO-AHH-AAA!

BY THEODORE J. GOURLEY

Introduction

A few minutes of action on the movie screen involves months of conceptualization, writing, planning, designing, and organizing people and materials. The classic scenes in **Star Wars** become even more spectacular when one sees the P.B.S. television show "The Making of Star Wars." Each scene involving special effects started with an idea, then a written description, followed by an analysis of the problem and numerous designs and tests before the producers found the right solution. This is the creative problem-solving process.

Many of these special effects sequences are produced by small, specialized studios. The large studio which is making the picture may contract with one of these small specialty studios for specific scenes or effects.

You and your colleagues have formed a small special effects film company. You are interested in acquiring contracts with major studios, but you are unknown. However, you have a chance to demonstrate your ability at the upcoming Film Technology Exposition, sponsored by the Modern Art Museum and the Consortium of Motion Picture Producers. All you need to do is to create a two-minute sample of your work to exhibit at the Exposition.

PROBLEM STATEMENT

Design and produce an original two-minute videotape presentation* which uses props, special effects, or natural settings to convey the impression of another environment or location; creates or dramatically changes a main character (human or other life form) which will interact with the other characters or environment; and creates the appearance of danger to the characters.

DEVELOPMENTAL STEPS

1. Critically examine movies and T.V. shows that use special effects. Some examples are **2001: A Space Odyssey**, **Star Wars**, **Goonies**, **Gremlins**, **Indiana Jones**, and **Ghostbusters**.
2. Study how special effects are created. In addition to using the books listed in the Bibliography, you can consult the **Reader's Guide to Periodical Literature** under "Motion Pictures Special Effects." This source lists special effects articles which have appeared in **Theater Craft**, **Newsweek**, **Omni**, **Popular Mechanics**, and many other magazines.
3. Obtain technical help from someone who is experienced in film or video productions. This help is to teach you how to produce your videotape, not produce the tape for you.
4. Formulate the story line and script for your video presentation, including setting, dialog, action, characters, etc. Create special effects which enhance the presentation. Be sure to include a novel environment, a main and other characters, and danger.
5. Practice and tape your two-minute presentation.

* If video equipment is not available, a skit may be substituted.

PRESENTATION

1. Each team has 10 to 15 minutes for set-up, presentation, and clean up.
2. A team member should introduce the video.
3. Each video should clearly show special effects through the environment, a human or other life form that interacts with other characters, and the appearance of danger.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

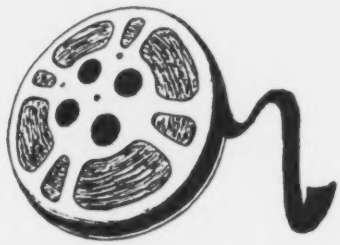
CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about inventions and/or inventors that have affected entertainment in the past 100 years.

EXAMPLE: _____ invented the motion picture.

a. Thomas Edison
b. Henry Ford
c. Orville Wright
d. Samuel Goldwyn

ANSWER: a. Thomas Edison



Intermediate: Teams prepare and ask questions about the relationship between entertainment and technology in the last 100 years. The questions should be written as analogies.

EXAMPLE: The film is to movies as wax was to _____.

a. museums
b. records
c. movies
d. carnivals

ANSWER: b. records (Phonograph record masters were printed on wax.)

Advanced: Teams prepare and ask questions about the relationship between technology and entertainment in the last 100 years. The questions should be written as riddles.

EXAMPLE: Is it me or someone else?
My voice stacks on the shelf.
My name suggests metallic,
Although I'm really synthetic.
And with me you can make beautiful music
With no lessons at all.
What am I?

a. brass instrument
b. magnetic tape
c. kazoo
d. radio

ANSWER: b. magnetic tape

EVALUATION

Points Received		Possible Points
____	1. A video or skit using special effects was produced.	30
____	2. The video or skit was appropriately introduced.	10
____	3. The video or skit uses props, special effects or natural settings to convey the impression of another environment or location.	10
____	4. The video or skit uses a main character who interacts with the other characters.	10
____	5. The video or skit creates the appearance of danger to the creature and/or characters.	10
____	6. Debriefing showed understanding of the problem and solution process.	10
____	7. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	8. Bonus points for elaboration and creativity.	10
____	**TOTAL**	100

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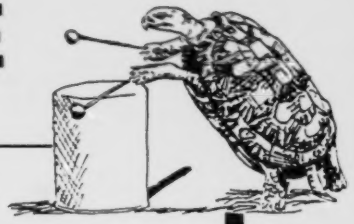
STRIKE NOTICE



BY TERRY MCELROY

Introduction

By an overwhelming "yes" vote, the combined membership of AFTRA (American Federation of Television and Radio Artists), SAG (Stage Actors Guild), and AFM (American Federation of Musicians) authorized a strike against the producers of musical videos.

You are the owner of the famous music video agency, Dynamic Visuals and Sounds, Inc. During the strike, MTV, VH-1, the Black Entertainment Network, and other video stations must fill their air time, but they may not use any existing tapes. These stations do not want to lose their vast viewing audience. They want to keep those who like acid rock, soft rock, country and western; they also want to keep those who like classical, easy listening, and show music. They demand originality and a variety of themes and moods. Your job is to supply an original three-minute music video without the use of live actors, singers, or musicians—or traditional instruments.

PROBLEM STATEMENT

Produce a three-minute music video which has a theme, melody, and lyrics.* The melody must be composed of sounds created by any means other than the use of traditional musical instruments; however, such instruments may be used in an unconventional way.

DEVELOPMENTAL STEPS

1. Research the history of musical composition. Study the families of instruments, their sounds, and their construction.
2. Look for sources of sound all around you. Make a list of the producers of sound in your everyday environment.
3. Find out about poetry and compare forms and styles. Evaluate various types of music lyrics as they relate to poetic forms and styles.
4. Research film, video, sound, and lighting methods.
5. View and discuss the use of sound and visual techniques in music videos, puppet shows, cartoons, commercials.
6. Decide on the subject, or theme, of your video. The subject could be a person, place, or thing in your school or elsewhere; it could be anything songs are written about. Pick something interesting to your team and the class.
7. Write lyrics to describe your subject. The lyrics can tell a story, make a joke, or just be aesthetically pleasing.
8. Decide how will you create sounds to communicate the subject and accompany the lyrics.
9. Create the visual elements to go with your "sound track." Your visual representation must correspond to the musical theme. It can include anything but humans "on camera."

*If video equipment is not available, a live skit may be substituted.

10. Put it all together in a three-minute visual presentation. The video must include balance and mood, and be interesting. Humans may not be seen. Practice your presentation, then tape it.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.

2. A member of the team should introduce the video (or skit).

3. The video may be shown a second time so that the audience can note the elements of balance, color, tone, and value.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.

2. The team should describe the special (distinguishing) elaboration features included in their presentation.

3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.

4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

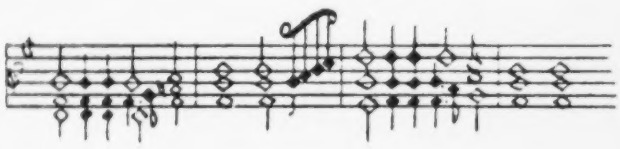
Basic: Teams prepare and ask multiple choice questions about the techniques used in music, poetry, or visual arts to modify an artistic element.

EXAMPLE: What quality of a color have you changed when you add white to any color of paint?
- a. value
- b. texture
- c. form
- d. accent

ANSWER: a. value

Intermediate: Teams prepare and ask questions about the techniques used in creating elements involved in music, poetry, and visual arts. The questions should be written as analogies.

EXAMPLE: Repeating a series of long and short sounds is to rhythm in music as repeating a series of large and small _____ is to rhythm in art.

- a. colors
- b. shapes
- c. tones
- d. accents

ANSWER: b. shapes

Advanced: Teams prepare and ask questions about techniques used in music, poetry, and visual arts. The questions should be written as riddles.

EXAMPLE: You can find me in nature.
The deer know my trick.
The clocks know my secret,
With their tock tock tick tick.

Artists, composers, writers of verse
Use me, use me, use me
Till I feel I might burst,
Till I feel I might burst.

What am I ?

ANSWER: repetition

EVALUATION

Points Received		Possible Points
	1. A video or skit was produced which contains:	
____	• a theme	10
____	• melody	10
____	• lyrics.	10
____	2. The musical composition uses sounds created by non-traditional "instruments."	10
	3. The video or skit includes:	
____	• balance	10
____	• mood	10
____	• interest value	10
____	4. Debriefing showed understanding of the problem and solution process.	10
____	5. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	6. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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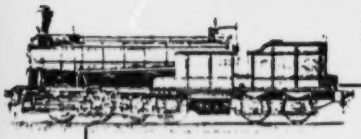
YANKEE INGENUITY



BY JUDITH E. BURR AND THEODORE J. GOURLEY

Introduction

Walt Disney's **Ben and I** provides an entertaining look at both the creative, playful mind and practical, analytical voice which live symbiotically in a great inventor. In this case, the inventor is Ben Franklin and the analytical voice is one Amos Mouse. It is Amos who guides the ordinary Franklin to discover many great things and ideas through often simple suggestions. In one sequence, Amos points out to the freezing Ben that he wouldn't be so cold if all his heat wasn't going up the chimney. The result was the Franklin stove.

The real Ben Franklin's ideas went beyond warming the citizen to inflaming the spirit of a nation. The year 1776 gave birth to the American Revolution; then, the 1787 Constitutional Convention in Philadelphia gave birth to the American nation. Ben's skills figured strongly in that convention, and, as that summer's decisions were implemented, our government came to life.

PROBLEM STATEMENT

Choose one problem represented by the inventions on the list below. Then, study an invention which has solved the problem in the past and create a new invention to solve this problem even more effectively in the 1990's.

INVENTIONS LIST

- **Clothing**
  Safety pin, velcro, rubber rain coat, zipper, disposable diaper, nylons, space suit, work shoes, rain gear.
- **Communication**
  Videocassette recorder (VCR), color TV, typewriter, computer, telephone, telegraph, communications satellite, mimeograph, instant camera, polygraph, radio astronomy.
- **Food, Nutrition, and Cooking**
  Tang, Mason jar (canning), refrigeration, ice cream cone, freeze dry process, infant formula, hybrid corn, microwave oven, combine harvester, herbicide, condensed milk, milking machine.
- **Health & Medicine**
  Polio vaccine, contact lens, cellbank, iron lung, pacemaker, heart-lung machine, artificial heart and valves, measles vaccine, human blood groups, dental chair and dental drill, bifocals, genetic code.
- **Housing & Domestic Convenience**
  Mosquito netting, solar panel, flush toilet, vacuum cleaner, electric light, air conditioner, trundle bed, carpet sweeper.

(Continued on following page)

- **Transportation**
  Airplane, carriage, steamboat, motorcycle, helicopter, in-flight refueling, pullman car, liquid fuel rocket.
- **Other** (services, processes, materials, systems)
  Pony Express, plastic, Teflon, public education, vulcanized rubber, atomic clock, barbed wire, cash register, direct current electric motor, infrared photography, laser, lightning rod, mass production process, solar battery.

DEVELOPMENTAL STEPS

1. Contact museums, historical commissions, historical sites, and libraries to find what displays and written materials they have on American inventors and inventions.
2. Find out about American inventors and their inventions. Don't be surprised to learn that some items were invented simultaneously, repeatedly, or by immigrant inventors (with ties to the U.S.A. and other countries). Consider not just invented objects like the airplane, but systems and procedures which Americans have devised to solve their problems: the Pony Express, flooding cranberry bogs to harvest the berries, food stamps.
3. Read about the development of such major inventions as the steam engine, for which several persons claimed credit.
4. Examine the definitions for patent, trademark, copyright. To what rights (and responsibilities) does each entitle the holder? What must the holder do to obtain these certifications?
5. Sometimes it is the gadget of everyday need which has the greatest impact on society—imagine your life without pencils, zippers, or Kleenex! To help your team narrow its thinking about inventions and problems, look around your classroom, the school cafeteria, the nurse's office, the gym. What articles (or procedures or systems) are used which have evolved from others (computer-pencil/paper-chalk/slate). How could these solutions still be improved upon?
6. Decide on the problem you will solve. How has the problem changed over time? What inventions have helped with this problem? What kinds of improvements could be made?
7. Think about the 1990's invention which your team will create, and discuss what is meant by "current breakthroughs" and "emerging technologies." Two "hot" examples you might review are super-conductors and genetic engineering. Examine current magazines that feature news about American (or global) problems that are being solved. Sources to consider include **Omni Magazine** and the science/technology section of **Time Magazine**.
8. Create an invention. Design it in schematic (blueprint) form or write description of it. Then build a functioning model of at least part of the invention.
9. Develop a skit around the problem to be solved, the old invention, and your team's new one. Be sure to include the advantages of your new invention.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. The team should present its schematic or written description to the judges.
3. The team should state the problem to be solved and then demonstrate the old invention and new one in a skit form.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.

2. The team should describe the special (distinguishing) elaboration features included in their presentation.

3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.

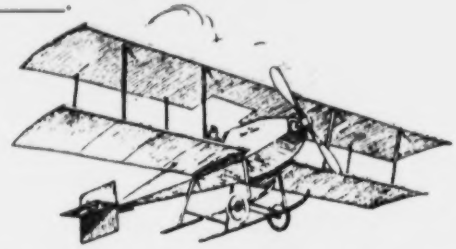
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about American inventions and their functions.

EXAMPLE: The Wright Brothers' experiments at Kitty Hawk resulted in Americans being able to _____.

a. swim
b. sail
c. fly
d. type



ANSWER: c. fly

Intermediate: Teams prepare and ask questions about American inventions and their functions. The questions will be written as analogies.

EXAMPLE: The telegraph is to Morse code as _____ is to the telephone.

a. the written word
b. the spoken word
c. a ringing bell
d. the pole

ANSWER: b. the spoken word

Advanced: Teams prepare and ask questions about American inventions and their functions. The questions should be written as riddles.

EXAMPLE: I keep you safe
From thieves at night.
I tell you when you can turn right.
On the tree
I'm a lovely Christmas sight.
So, what am I?

ANSWER: an electric light

(EVALUATION AND BIBLIOGRAPHY ON FOLLOWING PAGE)

EVALUATION

Points Received		Possible Points
____	1. An invention was selected and the problem was defined.	10
____	2. A new invention was created and designed in schematic or written form.	20
	3. A skit was presented which:	
____	• discussed the problem to be solved	10
____	• presented the old invention	10
____	• demonstrated the new invention with a working model	10
____	• discussed the advantages of the new invention.	10
____	4. Debriefing showed understanding of the problem and solution process.	10
____	5. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	6. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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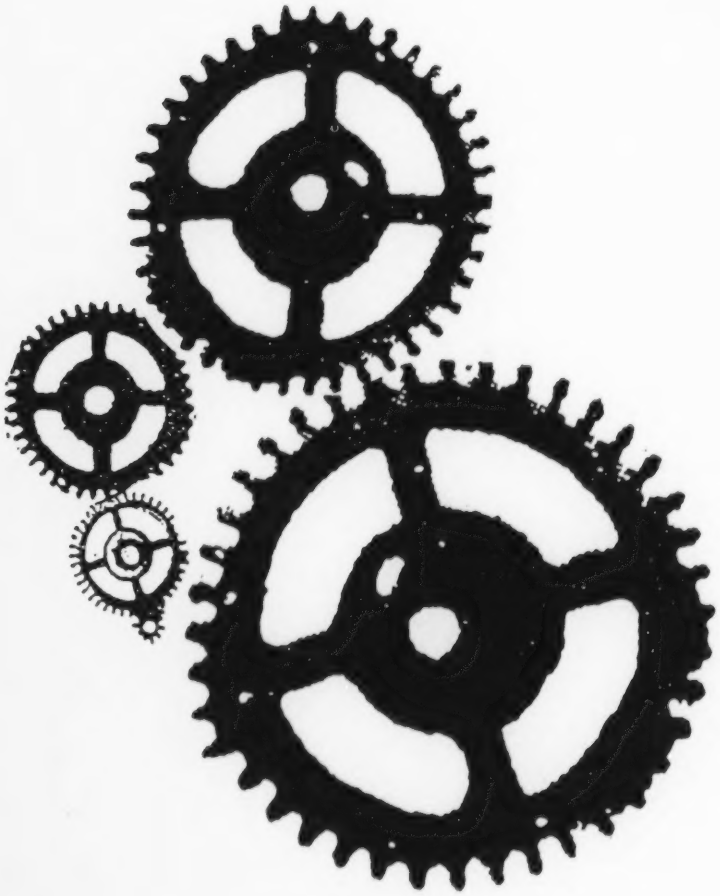
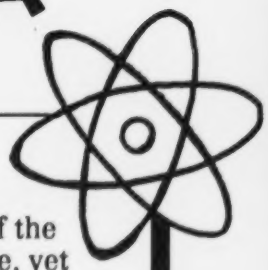
Science Problems



ATOMIC CAFETERIA

BY CAROL B. TREMPER WITH JUDITH E. BURR



Intrbduction

Look. Listen. Taste something. Sniff the air. Feel a surface and think of the many textures in our world. Our senses pick up differences everywhere, yet all this variety is made up of only 103 different ingredients called elements. Elements combine as molecules or compounds to make up every different item in the whole world, from gases to liquids to solids. These same 103 elements make up everything in the universe, even other planets. (Three new elements were discovered between 1969 and 1974, but have not yet been officially named.)

Elements are made of atoms. In the universe, however, some atoms are more common than others. Think of all the atoms in the universe as pennies in a dollar. Of the dollar, $.90 is a single gas, the element hydrogen. Another gas, helium, makes up $.09. All the other elements, 101, count for just the final penny.

Think of your team as a group consisting of an Atomic Chef and puppets in an atomic cafeteria, finding and sharing a molecular recipe for an ordinary compound in a clever, entertaining way. Your audience has to identify your elements and compound from hints your puppets give.

PROBLEM STATEMENT

Demonstrate in a skit some ELEMENTary cooking, choosing elements to combine into molecules of a compound, using puppets and one human performer, the Atomic Chef. Your puppets will present hints to the audience to help them identify the elements and resulting compounds.

DEVELOPMENTAL STEPS

1. Study basic characteristics of atoms, elements, molecules, and compounds.
2. Learn how to recognize a chemical formula, or recipe. Also, become familiar with the letter symbols for common elements listed in the chart below.
3. Review the list of compounds listed below. Select and research one which appeals to you. Find out about the characteristics of the component atoms, as well as the compound.

COMPOUND AND FORMULA LIST

Common Name	Technical Name	Molecular Formula
ammonia (household)	ammonium hydroxide	NH_4OH
baking soda	sodium hydrogen carbonate	$NaHCO_3$
carbon dioxide	carbon dioxide	CO_2
epsom salt	magnesium sulfate crystals	$MgSO_4$-$7H_20$

COMPOUND AND FORMULA LIST (continued)

Common Name	Technical Name	Molecular Formula
limestone & chalk	*calcium carbonate*	$CaCo_3$
moth balls	naphthalene	$C_{10}H_8$
peroxide	hydrogen peroxide	H_2O_2
plaster of paris	calcium sulfate	$(CaSO_4)_2\,H_2O$
quartz	silicone dioxide	SiO_2
rust	iron oxide	Fe_2O_3
salt (table)	sodium chloride	NaCl
soap	sodium stearate	$C_{17}H_{35}COONa$
sugar	sucrose	$C_{12}H_{22}O_{11}$
vinegar (weak)	acetic acid	$HC_2H_3O_2$
water	hydrogen oxide	H_2O
water glass	sodium silicate	Na_2SiO_3

4. Find out about the art of puppetry and making puppets.
5. Design a puppet show (skit) with one human performer, the Atomic Chef, and a puppet representing each element of the compound selected. During the show, the chef should demonstrate your understanding of atoms, elements, molecules, and compounds.
6. For each element, the puppets should give the audience 4 specific hints: visual, sound, touch (physical object), and riddle. The Atomic Chef should do the same for the compound.

   Example for helium:

   - visual - balloon
   - sound - Donald Duck voice
   - touch - air pump
   - riddle - _____ is to floating, as gold is to valuable.

   The 4 hints per element and compound should be written on a card and given to the judges before your team starts its presentation. Hints may be given by individual puppets, by the group, or any combination.
7. As an extra hint, if necessary, the team should display a student-made Periodic Chart of the Elements with the entire boxes for certain elements blank (no letters, symbols, or number). These are the boxes for the elements in your compound.
8. Decide how your team will add special features to the presentation to make it more colorful, effective, aesthetic, and unique.
9. Practice your puppet show.

PRESENTATION

1. The team has 10 to 15 minutes for set up, presentation, and clean-up.
2. The team should present the card of hints to the judges.
3. The Atomic Chef and puppets should present 4 specific hints for each element and for the compound the team has chosen.
4. After each set of hints, the Atomic Chef should ask someone in the audience to identify the element or compound.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.

2. The team should describe the special (distinguishing) elaboration features included in their presentation.

3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.

4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about common atoms, elements, molecules or compounds, and their "recipes" or formulas.

EXAMPLE: What element puts the taste and smell into garlic and onion?
- a. hydrogen
- b. phosphorus
- c. sulfur
- d. carbon

ANSWER: c. sulfur

Intermediate: Teams prepare and ask questions which apply chemical principles to specific examples of atoms, elements, molecules, and compounds. The questions should be written as analogies.

EXAMPLE: Tarnish is to silver as _____ is to iron.
- a. corrosion
- b. rust
- c. brittleness
- d. blackening

ANSWER: b. rust

Advanced: Teams prepare and ask questions which describe specific compounds. The questions should be written as riddles.

EXAMPLE: I am the universal solvent.
Most of the earth is covered with me.
Human bodies are composed mainly of me.
I am a necessary ingredient for life.
What am I?
- a. water
- b. petroleum
- c. oxygen
- d. ozone

ANSWER: a. water (H_2O)

EVALUATION

Points Received		Possible Points
____	1. Hint card was presented to the judges prior to presentation.	10
____	2. Puppets represented each element and the Atomic Chef represented the compound.	10
____	3. Four hints were given for each element.	20
____	4. The audience guessed the elements.	20
____	5. Four hints were given for the compound.	5
____	6. The audience guessed the compound.	5
____	7. Debriefing showed understanding of the problem and solution process.	10
____	8. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	9. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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FLYING CARPET

BY JUDITH E. BURR AND THEODORE J. GOURLEY

Introduction

In the tales of the **Arabian Nights**, Scheherazade saves her own life and that of the other young women in the kingdom by taking the Sultan on a series of literary adventures. These adventures have been passed down through the ages as some of the most famous folklore of all time.

A common theme running through these stories is magic in words and magic in special objects. One of the magical objects was a flying carpet. Had there really been a flying carpet, Scheherazade might have chosen to save her life by actually taking the Sultan on a trip to strange and mysterious lands.

PROBLEM STATEMENT

Create a functional flying carpet that uses the flow of air to keep it aloft and to control its direction. The flying carpet will carry Scheherazade and the Sultan on an adventure. This adventure may be one of the tales of the **Arabian Nights** retold or a modern adaptation designed by the team.

DEVELOPMENTAL STEPS

1. Learn about the "Principles of Flight" listed below. You might read about model planes and hang gliders, visit a hobby shop or kite store, interview a pilot, visit a museum with displays on flight or fluid mechanics. Particularly notice devices developed to maintain and control flight (such as ailerons). Choose 3 principles you will demonstrate with your flying carpet.

PRINCIPLES OF FLIGHT

lift	thrust
power	angle of attack
directional control	bank and roll
drag	air pressure

2. Review some tales of the Arabian Nights—for example, "The Story of Aladdin," "Ali Baba and the 40 Thieves," "The Story of Sinbad the Sailor."
3. Collect and examine potential materials for your carpet, such as thin wire, straw, balsa wood, plastic, thin cloth, paper, etc. You may need "guide wires" to stabilize your carpet during "flight," just as a kite is stabilized by a string fed by the operator.
4. Consider sources to produce airflow—a portable fan or vacuum cleaner, for example. In what ways might you restrict or direct the airflow to get maximum stability and force?
5. Build your carpet using the Bernoulli effect (lift - increased pressure below and decreased pressure above) and test it. Remember, it must demonstrate the 3 principles of flight. For example: lift could show the carpet rising over a mountain to escape enemies.

6. Write your story in 3 episodes, each one demonstrating a principle of flight with your carpet. Whether you choose to retell an old tale or create a modern adaptation, include the following elements: amazing creatures, exotic lands and people, overcoming incredible odds, the use of wisdom and cunning over treachery and cruelty.
7. Experiment with ways to tell your story. A narrator could speak, actors/actresses could perform each episode, etc.
8. Experiment with scenery and props. How will you show the scenery and props? How will you show the scenery changing behind the suspended carpet as each of the 3 episodes unfolds? Some suggestions are to use a roll of scenery, flip chart, scrim and lights, etc. Be sure to include special features that will make your solution colorful, interesting, and unique.
9. Practice your presentation.

PRESENTATION

1. The team has 10 to 15 minutes total for set-up, presentation, and clean-up props.
2. After the carpet is aloft in front of the scenery, it should demonstrate 3 principles of flight, one for each of the 3 episodes of the adventure story. The team should also act out each episode.
3. One character in the tale should ask the audience to name the principles they see in the presentation.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions on principles of flight.

EXAMPLE: The following describes the shape of an airplane wing:
a. plane
b. baffle
c. wedge
d. airfoil

ANSWER: d. airfoil

Intermediate: Teams prepare and ask questions about the principles of flight and about devices which aid flight. The questions should be written as analogies.

EXAMPLE: The tail is to a bird as the _____ is to an airplane.

a. propeller
b. rudder
c. fuselage
d. engine

ANSWER: b. rudder

Advanced: Teams prepare and ask questions on the principles of flight. The questions should be written as riddles.

EXAMPLE: Up, up, up and away we go.
Why don't we fall? Why don't you know?
We have a vacuum over the wing.
So we can fly like anything.
It's the shape of the wing that makes this work.
With a smooth tilted aileron, with nary a jerk.
Now, name the phenomenon that lifts our flight.
It was used quite nicely by the brothers of Wright.

a. cause and effect
b. Bernoulli effect
c. power
d. airfoil

ANSWER: b. Bernoulli effect

(EVALUATION AND BIBLIOGRAPHY ON FOLLOWING PAGE)

EVALUATION

Points Received		Possible Points
____	1. The presentation included a flying carpet that flies.	10
____	2. The 3 selected principles of flight were demonstrated.	15
____	3. A tale was presented in 3 episodes.	15
	4. The tale included:	
____	• changing scenery	3
____	• amazing creatures	3
____	• exotic lands and people	3
____	• overcoming incredible odds	3
____	• use of wisdom and cunning over treachery and cruelty.	3
____	5. The audience could name the principles of flight demonstrated.	15
____	6. Debriefing showed understanding of the problem and solution process.	10
____	7. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	8. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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SAVE THE WHALES

BY HOWARD HERBERT

Introduction

Evil scientists have captured young whales of different varieties and are holding them in an underwater prison for deadly experiments. The prison is very dark, making it impossible to see the whales. The evil scientists have posted a killer shark in the prison to attack anyone trying to rescue the whales.

Your team of marine biologists are so familiar with the whales that they can identify them by touch. They will save the lives of the whales. The whales could be of the following types: Blue Whale, Narwhale, Sperm Whale, Humpback Whale, or Killer Whale.

PROBLEM STATEMENT

Create a non-verbal communication system which enables teammates to find each whale, identify it by touch, communicate its identity to other team members, and free it. Demonstrate the system in a skit which shows scientists freeing the whales while avoiding the killer shark.

DEVELOPMENTAL STEPS

1. Research the physical characteristics of 5 types of whales. Compare and contrast the size, shape, habits, and other unique characteristics of the whales.
2. Find out about sharks and compare them to whales. How do they compare in size, diet, environment, etc?
3. Select 3 of the 5 whales and make a model of each. The models should be approximately 2' in length, and 6" in diameter, and should emphasize the distinctive characteristics of each type.
4. Make a killer shark. The shark model should be on the same scale as the whale models.
5. Research and discuss non-verbal communication. What system of communicating do whales use? What are some non-verbal communications that humans use? Design a non-verbal communication system for the team to use. This system must enable the team to guide "divers" to whales, while avoiding the shark, and enable the "diver" to communicate the whale identities to the team. This system should be outlined and presented to the judges.
6. Practice identifying the whales by touch, as blindfolded "divers."
7. Practice guiding team "divers" using non-verbal communication.
8. Develop a skit for freeing the whales. In the skit one team member will serve as "captain" and will not be blindfolded. The other team members will be blindfolded "divers." The captain will place the whales and the shark in an "undersea prison," and release one diver to find the whales. The captain will guide the diver with non-verbal communication to a whale, while avoiding the

shark. When the diver finds a whale, he or she will communicate the identity non-verbally to the captain, who will announce the identification and whether or not it is correct. The diver will then come "ashore." The captain will remove the whale if correctly identified, and another team diver will go in. When any divers contact the shark, their turn ends.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. The non-verbal communication system outline should be presented to the judges.
3. One blindfolded team member at a time, the diver, should enter the "undersea prison" area. The captain should give non-verbal signals to direct the diver to avoid the shark and free the whales.
4. Upon reaching a whale, the diver must communicate non-verbally what type of whale is being released.
5. Action continues until all of the whales have been freed or no divers remain.

DEBRIEFING

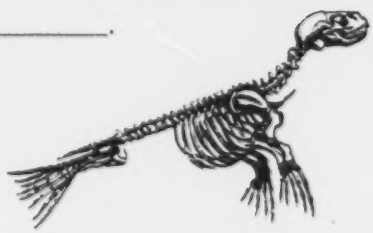
1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about whales and their habitats.

EXAMPLE: A favorite feeding place of whales is the _____.
- a. Mediterranean
- b. Baltic Sea
- c. Grand Banks
- d. Puget Sound

ANSWER: c. Grand Banks



Intermediate: Teams prepare and ask questions about whales and sharks. The questions should be written as analogies.

EXAMPLE: A whale's skeleton is to bone as a shark's skeleton is to _____.
- a. fiber
- b. cartilage
- c. skin
- d. tusk

ANSWER: b. cartilage

Advanced: Teams prepare and ask questions about whales and their undersea environment. The questions should be written as riddles.

EXAMPLE: What is the name that scientists give
To whales who roam the sea?
How like the cowboy's "Don't fence me in,"
Just let me wander free.
What am I?

ANSWER: open sea animal

EVALUATION

Points Received		Possible Points
____	1. The communication system was designed and an outline was presented to the judges.	20
____	2. Three distinguishable models of whales were created.	15
____	3. One shark representation was made.	5
____	4. The divers were able to find and identify the whales.	15
____	5. The divers were able to identify the whales and communicate their identity to the captain.	15
____	6. Debriefing showed understanding of the problem and solution process.	10
____	7. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	8. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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JUST HEAVENLY!

BY JUDITH E. BURR

Introduction

As the ship beamed neatly onto its landing pad, Rho snapped off the controls, turned to Xi and enthused, "Well! That was some training session, wasn't it? How'd you like those fantastic eclipses of Betelgeuse (a bright red star 527 light years from Earth, in the constellation Orion) while we were landed on the planet Snood with its 23 moons?"

"They were real nice lunar eclipses," said Xi, tentatively.

Rho wrinkled a silicoid brow. "You mean solar eclipses."

"Uh—oh yes, solar." Xi responded. "I meant that; it's just that I was so dizzy from Snood's revolving that I——"

"Rotating, Xi!" Rho looked crestfallen. "This galactic training course isn't really working for you, is it?"

"No," sighed Xi. "I really want my pilot's license, and I know I just must understand heavenly bodies and their movements to be a good driver. But the systems that we're looking at are so confusing! I can't keep dozens of moons, planets, and suns and what they do to each other straight. After all," Xi continued in self-defense, "I'm only six light-years old, and I've never seen a solar system up close, living my life on this pioneer space station. Couldn't we start with something simpler?"

Rho drummed a crystalloid digit on the control panel. "I see your point. Well, there is one small system about two light-years from here with one planet where you could observe this stuff in a simpler way."

"What's it called?" asked Xi hopefully.

"Earth." Rho flicked on the engines and off they warped.

PROBLEM STATEMENT

Choose an event in the heavens and demonstrate how it occurs in a skit. Team members will themselves be the heavenly bodies.

DEVELOPMENTAL STEPS

1. Research the heavenly bodies and their movement in the solar system. Visit your high school's earth science classroom. Examine models of the solar system; watch videos or films on the topic.
2. Contact your local planetarium; see if you can speak with the staff. Might they demonstrate some of the "heavenly events" with their equipment?

3. Use an almanac to locate upcoming "heavenly events" and find some that you can view with binoculars. Learn how the sun may be safely viewed (*under supervision*).
4. Select one of the "Heavenly Events" below to demonstrate.

HEAVENLY EVENTS

seasons	lunar eclipse
phases of the moon	solar eclipse
rotation and revolution of the Earth	sunrise and sunset
moonrise and moonset	day and night
planetary orbits in the solar system	

5. Plan a demonstration of your "heavenly event." Rather than make a model of it, however, the members of the team will themselves act out the heavenly bodies, demonstrating their movements in a skit. The demonstration is to be given with Earth as the primary reference point. It may, however, include additional bodies of the solar system for clarity, or to show that celestial phenomena are generic to other planets. If, because of limited space, not everything in the demonstration is to scale, a team spokesperson should explain these discrepancies to the audience.
6. Practice organizing your demonstration on a small scale, so each team member knows which path of movement he or she will follow. How will you identify each moving part so the audience can clearly follow your demonstration? How will the moving members be costumed?
7. Experiment with different materials and props to create convincing heavenly bodies; experiment with different light sources for your illuminated bodies or the rays they project.
8. Design a short skit to organize your demonstration. The skit should pick up just after Rho and Xi warp away in their spaceship toward Earth's solar system. What kind of elaboration features can you include?
9. As a driver in training, Xi must report to a review committee (the audience) back in the home galaxy and show a mastery level of learning. In the team's presentation, Xi must show an understanding of the phenomenon just demonstrated by using a two-dimensional format of the team's choosing.

PRESENTATION

1. The team has 10 to 15 minutes for set up, presentation, and clean-up.
2. The celestial occurrence should be presented in a skit using clearly identified team members as parts of the occurrence.
3. A two-dimensional format should show Xi's understanding of the event.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.

4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about celestial bodies and their movements.

EXAMPLE: When the Earth's axis is tilted toward the sun, we call it _____.
a. winter
b. summer
c. daylight
d. twister

ANSWER: b. summer

Intermediate: Teams prepare and ask questions about the relationship between heavenly bodies and their movements. The questions should be written as analogies.

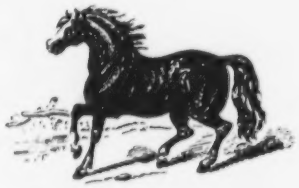
EXAMPLE: The earth is to lunar eclipse as _____ is to solar eclipse.
a. sun
b. moon
c. earth
d. darkness

ANSWER: b. moon (Just as the earth comes between the sun and moon to create a lunar eclipse, so the moon comes between the earth and the sun to create a solar eclipse.)

Advanced: Teams prepare and ask questions about the relationship between heavenly bodies and their movements. The questions should be written as riddles.

EXAMPLE: I have a tail, but I'm not a horse.
I have a path, but could go off course.
I must have the sun, 'tho a plant I'm not.
I can be very cold, then again very hot
What am I?

a. meteor
b. plasma trail
c. comet
d. constellation



ANSWER: c. comet

(EVALUATION AND BIBLIOGRAPHY ON FOLLOWING PAGE)

EVALUATION

Points Received		Possible Points
____	1. The team presented a "heavenly event."	20
____	2. The team used their members as the heavenly bodies.	10
____	3. The presentation used the Earth as the primary reference point.	10
____	4. Scale discrepancies were explained.	10
____	5. Props and lighting were used effectively.	10
____	6. Xi demonstrated mastery and presented a two-dimensional explanation to the review board.	10
____	7. Debriefing showed understanding of the problem and solution process.	10
____	8. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	9. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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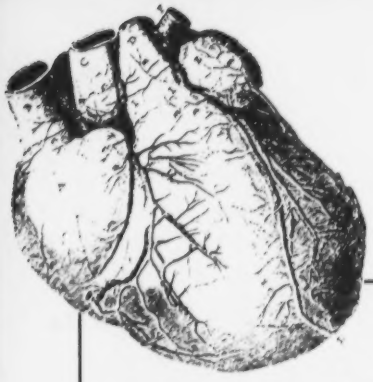


INSIDE OUT

BY JUDITH E. BURR

Introduction

All year long, Jamie has been struggling with the most awful science class ever. Not only is the information hard to understand and the book impossible to read, but the teacher never explains anything! It was bad enough when the class was studying bugs, rocks, and plants—but at least you could *see* them. Now the subject is human body organs and their functions—and how are you supposed to see *them*?

It is the night before the test. Thoroughly confused and exhausted, Jamie drops off to sleep on top of the textbook...and wakes up inside the human body! "Hello there!" says a voice. Jamie jumps to find Hemo, the famous blood cell guide (and now exactly Jamie's size) resting on the side of a vein.

"Perhaps I could be of assistance." Hemo continues, "Now just which organ seems to be causing you the greatest problem?"

PROBLEM STATEMENT

Choose an organ and demonstrate its major components and their functions in a skit. The members of the team will themselves be the components of the organ.

DEVELOPMENTAL STEPS

1. Write for information on or visit "larger than life" exhibits, such as the famous walk-through heart at the Franklin Institute in Philadelphia, Pa. View films which give an "inside view" of living things, for example Nova's **The Incredible Journey**, or the movie **Innerspace**.
2. Use the library and your school's science department to obtain basic books on human organ systems, their structures and functions.

   Note: Two or more **organs** comprise a **system**; do not to try to illustrate an entire system.
3. Choose an organ from the list below and discuss unique ways of transforming team members into its components to actively demonstrate the organ's functions. If you choose a symbolic representation of components and functions, be daring and consider the strong role humor can play.

ORGAN LIST

stomach	eye	tooth
pancreas	ear	bone
small intestine	brain	heart
kidney	tongue	lung
	skin	

4. Design a skit using Jamie, Hemo, and the chosen organ components as characters. Be sure to include colorful, interesting, and aesthetic features to make the solution unique. Use costumes, props, and scenery as appropriate.
5. At least 3 components of the organ chosen must be illustrated (example for the stomach: gastric glands, lining, smooth muscles). At least 3 specific functions of the organ must be actively demonstrated by the components (example for the stomach: entrance of food, chemical breakdown, and exit of food from the stomach).
6. Hemo should guide Jamie through the organ, explaining to the components as they are encountered and the functions as they are demonstrated. This same information should be listed on a 3 x 5 card and handed to the judges before the team's presentation begins.
7. Practice your presentation.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up
2. The team should present the card describing the organ, components, and functions to be demonstrated to the judges.
3. The team should present their skit with Hemo, Jamie, and the organ components.
4. At the end, Hemo should ask the audience to name the organ, components, and functions.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

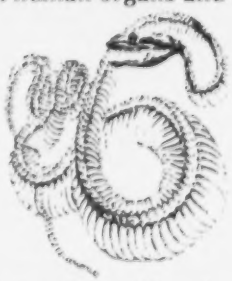
CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about human organs and their functions.

EXAMPLE: _____ cells make up the brain.

a. Fat
b. Bone
c. Nerve
d. Gray

ANSWER: c. Nerve



Intermediate: Teams prepare and ask questions about the relationships of functions to organs. The questions should be written as analogies.

EXAMPLE: Pancreas is to insulin as mouth is to _____.

a. teeth
b. saliva
c. sugar
d. speech

ANSWER: b. saliva

Advanced: Teams prepare and ask questions about specific organs and their functions. The questions should be written as riddles.

EXAMPLE: I make you laugh.
I make you cry.
I make you breathe.
I'll tell you why.
With me you learn all things you can.
And now please tell me what I am!

ANSWER: the brain

EVALUATION

Points Received		Possible Points
____	1. The team provided the judges with a card listing the organ, its 3 components, and 3 functions.	10
____	2. The skit included Hemo, Jamie, and 3 organ components as characters.	25
____	3. Three specific functions of the organ were demonstrated.	15
	4. The audience could name the:	
____	• organ	5
____	• components	6
____	• functions	9
____	5. Debriefing showed understanding of the problem and solution process.	10
____	6. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	7. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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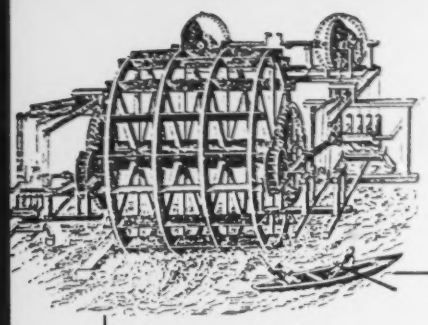
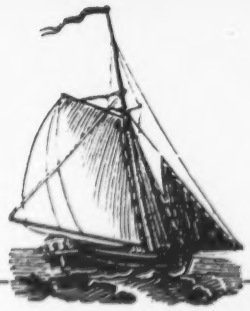


P(H_2O)WER

BY ADELE M. BOURNE



Introduction

Hercules, according to legend the greatest Greek hero and strongest man on earth, was the first known hydraulic engineer. When he had to clean the stables of King Augeas (who had thousands of cattle living in stalls that had not been cleaned for years), he diverted the course of two rivers and cleaned them out in no time.

Archimedes, a Greek philosopher (287-212 B.C.) used water to determine the content of gold in King Hieron's crown. Blaise Pascal, a French mathematician (1623-1662 A.D.), found that water could lift weight. Hydrodynamics, meaning "the motions of water" in Greek, can be harnessed as energy.

Now your team is going to safely contain a radioactive metal using hydrodynamics. In a recent near-tragic accident, given national coverage on the news media, a large amount of highly radioactive metal fell out of its protective casing. As it is naturally too "hot" to be touched safely by humans, it has to be moved hydraulically to a containment area.

PROBLEM STATEMENT

Design waterworks that demonstrates your team's ability to move a gallon of water from one container to another so that half a pound, 8 ounces, of "hot" metal is lifted over a barrier (the edge of the safe containment area). Have a "reporter," who is at the site providing TV coverage, explain the movement of the metal.

DEVELOPMENTAL STEPS

1. Research air and water pressure, the laws of fluid mechanics, and Newton's third law of motion.
2. Research locks, dams, hoses, water mills, and other inventions which harness the force of water.
3. Use at least 3 of the forces listed below to move the radioactive metal. Explain, while the water is being returned to its original container, just what forces were employed and why.

LIST OF FORCES

air pressure	gravity	adhesion
water pressure	cohesion	viscosity
vacuum	displacement	density
friction	surface	buoyancy
turbulence		

4. Design a waterworks to transport the "hot" metal from the container where it was dropped to another, "safe" container.
   - The "hot" metal (approximately 8 ounces) must be transported over a barrier of at least 3 inches above the containers and land intact on the other side in the safe containment area.
   - The liquid and the metal should not be touched directly by hand at any time after the demonstration begins (as, of course, the water is radioactive from contact with the radioactive metal)
   - The base of each container should remain stationary (level) throughout transfer of liquid.

5. Design and practice a skit wherein your waterworks is demonstrated. Have an announcer or reporter explain (on T.V.) each force used to move the metal while it is moving the water. Other people in the presentation might be scientists, guards, etc. Be sure to include special features which will make your presentation colorful, interesting, and unique.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.

2. A "reporter" should describe the nature of the "accident" that occurred and what is happening as the "metal" is moved over the barrier.

3. A team member should describe the forces that were harnessed in the waterworks.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.

2. The team should describe the special (distinguishing) elaboration features included in their presentation.

3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.

4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about a mechanism that moves water or uses water to move something else.

EXAMPLE: The name of a device for lifting water from the hold of a large ship was the _____ Screw.

a. Cartesian
b. Archimedes
c. Rumford
d. Edison

ANSWER: b. Archimedes

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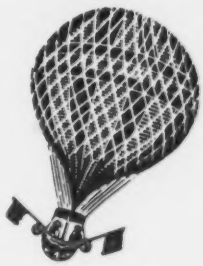
Intermediate: Teams prepare and ask questions about the relationship of a machine or device that moves water or uses water to move something else and a machine or device that moves air or is moved by air. The questions should be written as analogies.



EXAMPLE: A coracle is to a frisbee as a submarine is to a _____.
- a. 707
- b. biplane
- c. hot-air balloon
- d. barnacle

ANSWER: c. hot-air balloon (a coracle is a small round boat.)

Advanced: Teams prepare and ask questions about the importance, meaning, application, and creation of principles of fluid mechanics. These principles include Archimedes' Law of Floating Bodies, Newton's Third Law, Pascal's Law, Bernoulli's Principle, cohesion, adhesion, and viscosity. The questions should be written as riddles.

EXAMPLE: Water flows through the hose
On a sunny day.
Give the hose a squeeze
For a stinging spray.
Increase the pressure—
Increase the speed.
Who below
Explained this deed?

- a. Newton
- b. Archimedes
- c. Bernoulli
- d. Pascal

ANSWER: c. Bernoulli

(EVALUATION AND BIBLIOGRAPHY ON FOLLOWING PAGE)

EVALUATION

Points Received		Possible Points
	1. The waterworks met the design specifications:	
____	• The weight of radioactive metal weighed approximately 8 ounces	10
____	• The metal was transported over the barrier.	10
____	• The containers remained stationary.	10
____	• The liquid and metal were not touched during the transfer process.	10
____	2. The demonstration was set in a skit which described the accident and the transfer process.	15
____	3. The team described principles of fluid mechanics used in their demonstration.	15
____	4. Debriefing showed understanding of the problem and solution process.	10
____	5. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	6. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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WITCHES AND WIZARDS

BY JUDITH E. BURR

Introduction

History is filled with reports of "black" (harmful) magic practiced by witches and wizards. Not only was the magic harmful, but, because no one could determine how it was done, no one could prevent the frightening events attributed to it.

"White" (beneficial) magic has not received as much publicity. For example witches and wizards cured skin boils, reduced fever, eliminated pain, and killed germs to help their clients. Such healers were some of our earliest chemists. They used natural herbs as a basis for their "magic." Interestingly, two of today's most widely used drugs for heart disease and asthma were discovered by these herbal practitioners—digitalis and ephedrine.

You and your team, deeply involved in chemical investigations, have been advanced to the ranks of witches and wizards. While on retreat in the Crystal Cave, perfecting new "white magic" practices to solve mental, emotional, and physical problems, you receive a message that your clients need you back at school. Transported back by extraordinary means, you see them anxiously lined up, awaiting your arrival.

PROBLEM STATEMENT

Solve a client's mental, emotional, or physical problem through the "white magic" of chemistry. The problem should be revealed in a short dramatic scene, and the solution should take the form of an actual chemical demonstration.

DEVELOPMENTAL STEPS

1. Look up the original definitions for "witch" and "wizard" and the terms from which they were derived. How have their meanings changed from the Dark Ages to present day?
2. Study basic chemistry terms and concepts, including the following:
   - matter (the three forms)
   - energy
   - element, mixture, compound
   - physical vs. chemical changes
3. Examine handbooks or activity books for the amateur scientist. These are frequently a source of chemical experiments that are safe, inexpensive, and give visible results quickly. Because of the potential danger inherent in chemical reactions, DO NOT design your own experiment; use one found in your research.

4. Brainstorm possible "client" problems to be solved; select one or more to investigate.
5. Choose a chemical demonstration which can "solve" your client's problem and feature it in a convincing "magical" presentation. The use of any possible hazardous procedures such as open flames, explosions, caustic solids, liquids, or vapors is not allowed.
6. Review the demonstration with your teacher before proceeding.
7. Develop a presentation which includes the following components:
   - a description of the client's problem
   - the appearance or disappearance of something in the presentation through the "magic" of a chemical reaction
   - an explanation of the chemical processes involved in the solution.
8. Describe these components in writing for the judges; if possible, also provide the chemical equation for the reaction.
9. Practice your presentation; appropriate safety procedures must be used.

WHITE MAGIC EXAMPLE

Client's problem:

Jeff is struggling with nightmares that are just terrible! Every night creatures leer at him in the darkness and breathe hot fumes over his bed as he lies there defenseless! No sooner does he jump awake from one dream than he falls back asleep to be attacked by creatures all over again. This is getting exhausting!

The Witches' and Wizards' solution:

Jeff needs an effective guard. A glass bottle partially filled with liquid, over which a package of powder is suspended is designed for him. A deflated balloon is stretched acoss the bottle top.

The first time Jeff jumps awake, he grabs the bottle and tips it so the powder spills into the liquid. Then he rights the bottle and places it back on his bed table. Now the balloon "magically" inflates making a grotesque face appear — Jeff's guard for the rest of the night!

How does it work?

The liquid is diluted acetic acid (vinegar); the powder is sodium bicarbonate (baking soda). The chemical reaction caused by mixing them produces sodium acetate, water, and carbon dioxide gas, which inflates the balloon on which the grotesque face is painted.
The chemical equation is:

$$NaHCO_3 + C_2H_4O_2 \longrightarrow H_2O + CO_2 + NaC_2H_3O_2$$

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. The presentation should include a description of the client's problem, the appearance or disappearance of something, and an explanation of the solution.
3. The judges should be given in written form a description of these components.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.

3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.

4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions that require knowledge of basic elements, compounds, mixtures, and forms of matter.

EXAMPLE: Dry ice is an example of _____ in a solid form.
a. water
b. an element
c. smoke
d. carbon dioxide

ANSWER: d. carbon dioxide

Intermediate: Teams will prepare and ask questions about chemical principles. The questions should be written as analogies.

EXAMPLE: Lemon juice is to acid as Tums is to _____.
a. acid
b. stomach
c. base
d. nausea

ANSWER: c. base

Advanced: Teams prepare and ask questions about the use of chemicals and chemical principles in everyday life. The questions should be written as riddles.

EXAMPLES: I come from the bark of a weeping willow,
But I keep you from weeping with pain.
I am not cold,
But I keep you from staying too hot.
I am dry,
But I keep you from swelling with fluid.
I am inexpensive,
But I've made pharmaceutical companies rich.
What am I?

ANSWER: aspirin

(EVALUATION AND BIBLIOGRAPHY ON FOLLOWING PAGE)

EVALUATION

Points Received		Possible Points
____	1. The problem was presented and described in a dramatic setting.	20
____	2. The problem was solved through the appearance or disappearance of something through a chemical reaction.	20
____	3. The team explained of the chemical process involved in the solution.	30
____	4. Debriefing showed understanding of the problem and solution process.	10
____	5. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	6. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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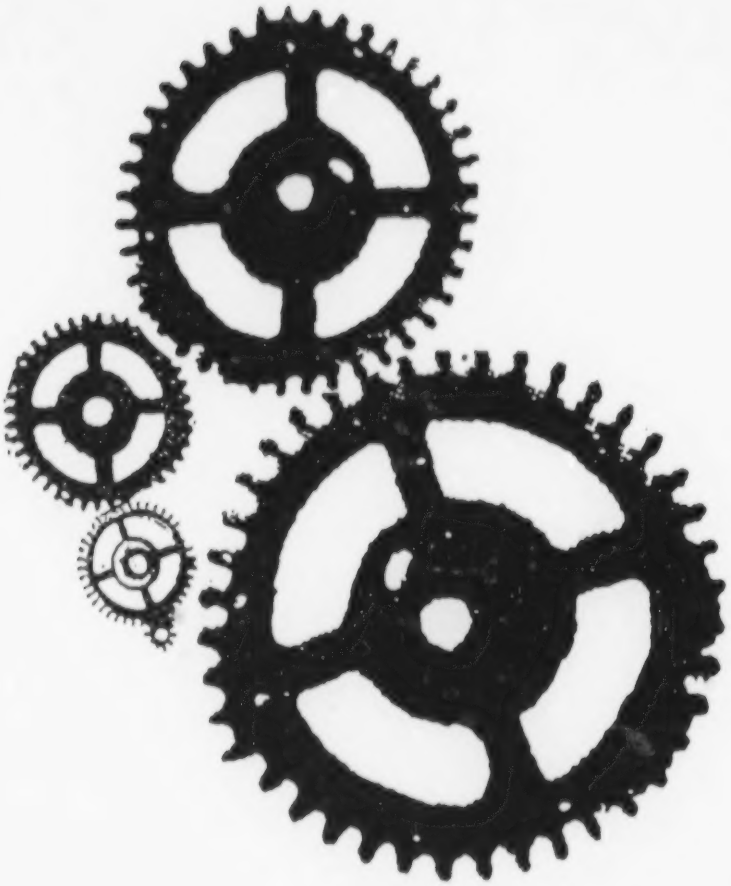
Appendix



APPENDIX

SAMPLE CHALLENGE QUESTIONS

This appendix contains sample challenge questions for 11 Cognetics problems. Not all challenge levels are covered for each project. The questions were developed by students participating in the Cognetics program in New Jersey, and the authors are indicated for each question. Readers are invited to submit new challenge questions, as well as other suggestions, for future editions of Cognetics.*

The questions are presented in the following order:

Inventions/Technology

- Contraption
- Feed Me
- It's In the Mail
- OOO-Ahh-AAA!
- Strike Notice
- Yankee Ingenuity

Science

- Atomic Cafeteria
- Inside Out
- Just Heavenly
- P($H_2$0)ower
- Witches and Wizards

*Send challenge questions or suggestions to: RBS Publications, Research for Better Schools, 444 N. Third St., Philadelphia, PA 19123

CONTRAPTION

A. BASIC LEVEL

1. School: Logan Township Intermediate School
   Author: Shannon Mitchell

   Question: What kind of gear operates a zipper?

   Answer Choices:
   a. worm gear
   b. wedge gear
   c. spur gear
   d. bent gear

   Correct Answer: **b. wedge gear**

B. INTERMEDIATE LEVEL

1. School: East Greenwich Elementary School
   Authors: Chris Taylor, Barbara Basile, Terri Savidge

   Question: Fulcrums are to levers as _____ are to gears.

   Answer Choices:
   a. pulleys
   b. teeth
   c. axles
   d. bases

   Correct Answer: **b. teeth**

2. School: West Paterson, Memorial School
   Authors: Chris DiMartino, Craig Castner, Mike Cannatarro

   Question: The barrel of a gun is to a bullet as a cylinder is to a _____.

   Answer Choices:
   a. piston
   b. sprocket
   c. valve
   d. coil

   Correct Answer: **a. piston**

3. School: William R. Satz School
   Authors: Steven Freeman, Jakob Halpern

Question: Gear is to oil as a ski is to _____.

Answer Choices:
a. snow
b. wax
c. oil
d. lift

Correct Answer: **b. wax**

4. School: Alfred C. MacKinnon Middle School
Authors: Aaron Loomis, Jon Howie, Michael Lorenzo

Question: Handle is to pencil sharpener as _____ is to bicycle.

Answer Choices:
a. chain
b. gear
c. pedal
d. frame

Correct Answer: **c. pedal**

C. ADVANCED LEVEL

1. School: West Essex High School
Authors: Peter Holleuffer, Glen Podaker

Question: Some people call me lazy because I lie on my side all day.
But they don't realize I can decrease the amount of work you have to do. Some people say I act like a wedge, but I tell them I'm not two-faced. What am I?

Answer Choices:
a. wheel and axle
b. pulley
c. inclined plane
d. block and tackle

Correct Answer: **c. inclined plane**

2. School: The Woodlynde School
Author: Joel A. Hurewitz

Question: I am a simple machine that is found on a screw.
If you use a zipper, I am used by you.
I go up, but I also go down.
I am a common item 'cause I'm found all around.
What am I?

Answer Choices:
a. pulley
b. lever
c. inclined plane
d. gears

Correct Answer: **c. inclined plane**

3. School: Burlington City High School
Authors: Jasen McConnell, Robert Hopp, Tom Knight, Kristin Stayton, Alicia Mosca

Question:
Without them, wheels would roll
Away from your car and into a hole.
Cars usually have only two;
Trucks sometimes have more than a few.
If you break one on a very bad day,
You might as well throw your car away.
What are they?

Answer Choices:
a. batteries
b. hubcaps
c. levers
d. axles

Correct Answer: **d. axles**

4. School: Vernon Township High School
Authors: Matt Alaura, Mike Frazer, Jennifer McLaughlin, Yvonne LaForge

Question:
I'll get you where you want to go.
Oil will keep me cool as snow.
I have made Detroit my home.
If you use me, anywhere can you roam.
Motion is my key, only vertical not horizontally.
What am I?

Answer Choices:
a. gear
b. piston
c. gasket
d. axle

Correct Answer: **b. piston**

5. School: Redding Middle School
Author: Andy Walker

Question:
I cut through the water.
I cut through the air.
I slash with sharp blades,

But never make a tear.
I never lose my balance,
Though I spin round and round.
I can push very fast.
Who am I?

Answer Choices:
a. spoke
b. propeller
c. wheel
d. axle

Correct Answer: **b. propeller**

FEED ME

A. BASIC LEVEL

1. School: East Greenwich Elementary School
   Authors: Matthew Fiore, Robin Workman

   Question: A salad scissor is something that you use to _____.

   Answer Choices:
   a. cut up salad
   b. serve salad
   c. cut up the ingredients for a salad
   d. put the dressing on salad

   Correct Answer: **b. serve salad**

2. School: Landis Intermediate School
   Author: Michele Fauver

   Question: A separater is an object that separates the _____.

   Answer Choices:
   a. sugar lumps from the rest of the sugar.
   b. yolk from the white of an egg.
   c. salt from the sugar.
   d. lumps from gray

   Correct Answer: **b. yolk from the white of an egg**

3. School: Dr. William Mennies Elementary School
   Author: Dawn Fedor

   Question: Tongs are used for _____.

   Answer Choices:
   a. shoes in the summer
   b. picking up sizzling hot food
   c. cutting hard to cut foods
   d. wrestling

   Correct Answer: **b. picking up sizzling hot food**

B. INTERMEDIATE LEVEL

1. School: Dennis Township Elementary School
   Author: T.J. Bell

   Question: A pestle and mortar is to Roman times as a _____ is to modern day.

Answer Choices: a. ricer
b. food processor
c. cheese grater
d. juicer

Correct Answer: **b. food processor**

2. School: Kingsway Regional High School
Authors: Michelle Basile, Jodee Gahrs, Jerome Jackson, Ryan Messick, Katie Moffett

Question: The first knives are to flint as the first spoons are to _____.

Answer Choices: a. stone
b. wood
c. seashells
d. steel

Correct Answer: **c. seashells**

3. School: Charles Street Sacred Heart School
Authors: Andy Raup, Philip Bradshaw, Tyfanee Pratt, Dawn Guglielmucci, Brandi Adkins, Ashley McAllister

Question: Plastic fork is to medieval wooden knife as paper plate is to _____.

Answer Choices: a. china plate
b. bread slice
c. wooden board
d. tin cup

Correct Answer: **a. china plate**

4. School: William R. Satz School
Authors: Shyanski Wu, Steven Tow, Stephen Lee, Michael Wang, Alan Ng, Brian Dolan

Question: Chinese are to chopsticks as Polynesians are to _____ .

Answer Choices: a. spoons
b. forks
c. fingers
d. chopsticks

Correct Answer: **c. fingers**

5. School: Crest Memorial School
   Author: Kirk Blaker

   Question: Neanderthal man is to _____ as modern American man is to fork.

   Answer Choices:
   a. dinosaur teeth
   b. hands
   c. metal tool
   d. tree bark

   Correct Answer: **b. hands**

C. ADVANCED LEVEL

1. School: Warren Hills Regional Junior High School
   Authors: Simon Shapow, David Millard, Jason Meyler, John Riggs

   Question:
   When setting the table, I'm not on the right.
   Although to use me it takes not much might,
   I am good for picking up things.
   I go next to the napkin rings.
   I may look like a devil's spear,
   But I can pick food up without any fear.
   Who am I?

   Answer Choices:
   a. fork
   b. straw
   c. knife
   d. spoon

   Correct Answer: **a. fork**

2. School: Vernon Township High School
   Authors: Leelannee Sloan, John Esteve, Denine Cimmons, Jen Paskey

   Question:
   An ornate vessel without rudder or sail,
   I am moved and emptied by your appetite's gale.
   I hold liquid in, instead of out;
   My body is curved, with a delicate handle and greasy spout.
   My duty is to hold any consistency roux—
   Homemade suspensions or commercial colloids, too.
   What am I?

   Answer Choices:
   a. tea pot
   b. soup tureen
   c. gravy boat
   d. milk pitcher

   Correct Answer: **c. gravy boat**

3. School: Phillipsburg High School
Author: Kelsey Miller

Question: Seasoning foods is my job,
To add taste to corn on the cob.
Tip me over, and just like rain,
Out comes flavor in the form of grains.
What am I?

Answer Choices:
a. stick of butter
b. salt shaker
c. peas
d. peanut butter

Correct Answer: **b. salt shaker**

4. School: South Plainfield High School
Authors: Jason King, Paige Muccilli

Question: I have two parts from a tree.
I'm hard to hold as you can see.
I pick up food from my tips,
But with me you can't take sips.
In the East is where I'm found,
But I've been seen all around.
Who am I?

Answer Choices:
a. chopsticks
b. salad tongs
c. castanets
d. toothpicks

Correct Answer: **a. chopsticks**

5. School: Bordentown Regional High School
Authors: Lauren Blair, Danielle DiCicco, Renaye Jones, Sarah McEwan, Kelly Robinson

Question: I'm low and flat, down near the heat.
In melting butter, the eggs get beat.
Fish can cook and French toast bake.
There are numerous things that I can make.
What am I?

Answer Choices:
a. wok
b. frying pan
c. saucepan
d. casserole dish

Correct Answer: **b. frying pan**

6. School: Bridgeton High School
Author: Christina Parkhurst

Question: You use me... especially if you are a kid.
Portable ... easy to clean... durable ...
Yet I am not made of silver or steel.
What am I?

Answer Choices:
a. bottle
b. thermos
c. fingers
d. sticks

Correct Answer: **c. fingers**

7. School: Warren Hills Regional Senior High
Authors: Tom Winegar, R.J. Moyer, Nina and Marsha Tsai, D'Ana Reed, Christal Boddy, Gina Santillo

Question: My partner and I will help you to eat
Chinese food or most other treats.
We may be hard for some to use,
But with some practice we can be very fun.
We may drop food, but that does no harm,
The challenge to use us is part of our charm.
We come from traditions from a time in the past,
But our simple design means we'll surely last.
Click us together and large pieces we'll hold;
Smaller food is only for the expert who is bold.
So, with some practice it's easy to see
You'll have hours of fun. Can you guess who
are we?

Answer Choices:
a. tongs
b. chopsticks
c. salad spoons
d. forks

Correct Answer: **b. chopsticks**

IT'S IN THE MAIL

A. BASIC LEVEL

1. School: Rossi School
   Author: George Christianis

   Question: What country had the first public railroads?

   Answer Choices: a. England
   b. Japan
   c. America
   d. Cuba

   Correct Answer: **a. England**

2. School: Crest Memorial School
   Author: Bobby Polis

   Question: The first television set was built in the 1940s.

   Answer Choices: a. True
   b. False

   Correct Answer: **b. False**

3. School: Parsons School
   Authors: Stacey Lacina, Kelly Kish, Kevin Pflug, Stevie Helmeczi, Jason Seigert

   Question: Wiley Post invented the technological device that eventually eliminated the Pony Express.

   Answer Choices: a. True
   b. False

   Correct Answer: **b. False**

4. School: Parsons School
   Authors: Veronica Picone, Lauren Rudders, Michael Dipaolo, Christopher Montville, Dayna Glass

   Question: What machine arranges the letters so they point the same way, and marks the stamps so they cannot be used again?

   Answer Choices: a. stamp canceler
   b. edger-feeder

c. facer-canceler
d. letter LSM

Correct Answer: **c. facer-canceler**

B. INTERMEDIATE LEVEL

1. School: Crest Memorial School
   Author: Jeffrey Gibula

   Question: Egypt is to papyrus as _____ is to clay tablets.

   Answer Choices: a. Greece
   b. Mesoamerica
   c. Mesopotamia
   d. China

   Correct Answer: **c. Mesopotamia**

2. School: Memorial School
   Author: John Zollo

   Question: Copper is to electricity as fiber optics is to_____.

   Answer Choices: a. heat
   b. light
   c. binary code
   d. sound vibrations

   Correct Answer: **b. light**

3. School: MacFarland Junior School
   Authors: Jim Ardoin, Peter Brown, Scott Hoffman, Warren Horvath, Paul Romberger

   Question: TV is to picture as Morse Code is to _____.

   Answer Choices: a. sound
   b. light
   c. message
   d. radio

   Correct Answer: **c. message**

4. School: F. X. Walther School
   Authors: Joshua Simon

   Question: Samuel Morse is to the telegraph as _____ is to the Pony Express.

   Answer Choices:
   a. F. X. Aubrey
   b. Buffalo Bill Cody
   c. Senator William M. Guin
   d. Russel, Majors and Waddel

   Correct Answer: **a. F. X. Aubrey**

5. School: William R. Satz School
   Authors: Lev Kaufman, Bing Feng , Kevin Sachs, Nihal Bhujle

   Question: Antenna: soundwaves as _____: mail.

   Answer Choices:
   a. satellite
   b. telephone
   c. mailbox
   d. camera

   Correct Answer: **c. mailbox**

6. School: Ryerson School
   Authors: James Tabeek, Tanya Goyal, Stacie Ferralasco, Rachel Crowe, Bree Trufant

   Question: _____ is to envelope as wings are to an airplane.

   Answer Choices:
   a. Letter
   b. Return address
   c. Stamp
   d. Sealing

   Correct Answer: **c. Stamp**

C. ADVANCED LEVEL

1. School: South Plainfield High School
   Authors: Brian Menyuk, Michael Eng, Michael Weber, Ronald Raynond, Peter Chin, Dorsey Finn, Kevin Riley, Stephen Braynock

   Question: I fly through the air at a very high speed.
   I can carry a letter, package, or deed
   Safely, securely, and quickly indeed.
   A hollow cylinder is all that you need.
   What am I?

Answer Choices:
a. pneumatic air tubes
b. satellite
c. space shuttle
d. teleportation

Correct Answer: **a. pneumatic air tubes**

OOO-AHH-AAA!

A. BASIC LEVEL

1. School: Clayton Elementary School
   Authors: Allison Faure, Marie Fisher

   Question: What was the invention that enabled scientists to produce holograms?

   Answer Choices:
   a. synthesizer
   b. halogen lamp
   c. laser
   d. micro chip

   Correct Answer: **c. laser**

B. INTERMEDIATE

1. School: Memorial School
   Author: Jay Rosenberg

   Question: Phonograph is to 1878 as VCR is to _____.

   Answer Choices:
   a. 1982
   b. 1961
   c. 1955
   d. 1978

   Correct Answer: **b. 1961**

C. ADVANCED LEVEL

1. School: Bridgeton High School
   Authors: Andrew Wax, Greg May, Elvin Beardsworth, Leonard O'Mara

   Question:
   I'm not really there, but I'm on the screen.
   I 'm very important, but can't be seen.
   I make editing look crisp and clean.
   I'm used in filming "moving" scenes.
   I can make the illusion of flight
   And then change day into night.
   If you can get this riddle right,
   Then you should feel as high as a kite.

   Answer Choices:
   a. animation
   b. split screen

c. blue screen effect
d. dissolve

Correct Answer: **b. split screen**

2. School: South Plainfield High School
Authors: M. Kordelski, S. Sarao, T. Donnelly, B. Menyuk, A. Garbarini, K. Kalyka, E. Shepp, D. Gallo

Question: I give the film added depth.
My main colors are red and blue.
I look blurry with the naked eye;
But with this special gear,
The images on the screen appear ever so near.
What am I?

Answer Choices: a. Dolby sound
b. 3-D glasses
c. holograph
d. technicolor

Correct Answer: **b. 3-D glasses**

3. School: Burlington City High School
Authors: Jim Baer, Allison Brotz, Tony Clark, Bob Coppola, Christine Craig, Mike Dold, Jaenn Jo

Question: I am the heart of film-making.
I can defy time.
Without me, confusion and lack of continuity may reign.
Even though the industry has changed drastically,
I am the same as from the beginning.
What am I?

Answer Choices: a. editing
b. special effects
c. creativity
d. directing

Correct Answer: **a. editing**

A. BASIC LEVEL

1. School: Clayton Elementary School
   Authors: Rachel Cromley, Alison Leon

   Question: Changing the tempo of a song may also change the _____.

   Answer Choices:
   a. scale
   b. mood
   c. melody
   d. tone

   Correct Answer: **b. mood**

2. School: New Albany School
   Authors: Darren Bacon, Christie Burns

   Question: If you tap a row of glasses filled with different water levels, the pitch of the one with the most water will be _____.

   Answer Choices:
   a. loudest
   b. highest
   c. lowest
   d. softest

   Correct Answer: **c. lowest**

3. School: New Albany School
   Author: Katy Kelly

   Question: If you combine the sound of two instruments into one, what must change?

   Answer Choices:
   a. pitch
   b. timbre
   c. volume
   d. none of the above

   Correct Answer: **b. timbre**

B. INTERMEDIATE LEVEL

1. School: Crest Memorial School
   Author: Liz Vogel

   Question: Theme is to music as _____ is to art and literature.

   Answer Choices:
   a. motivation
   b. motif
   c. medium
   d. none of the above

   Correct Answer: **b. motif**

2. School: Valley Middle School
   Authors: Kristen Russo, Jennifer Smith, Holly Schulze, Alice Rentz

   Question: Light and shadow are to balance in art as piano and _____ are to balance in music.

   Answer Choices:
   a. guitar
   b. crescendo
   c. forte
   d. tempo

   Correct Answer: **c. forte**

3. School: Valley Middle School
   Authors: Jessica Zitcer, Jennifer Dickover, Erin Song

   Question: Imagery is to mood in poetry as _____ is to mood in music.

   Answer Choices:
   a. meter
   b. phrasing
   c. violin
   d. tone

   Correct Answer: **b. phrasing**

4. School: Dennis Township Elementary School
   Author: T.J. Bell

   Question: Rumba is to a rhythm in music as _____ is to a rhythm in poetry.

   Answer Choices:
   a. iambic
   b. verse
   c. sonnet
   d. stanza

   Correct Answer: **a. iambic**

C. ADVANCED LEVEL

1. School: Burlington City High School
   Author: Philip Powers

   Question: You'll find me in a bird
   Humming a beautiful song.
   You'll hear me in a dog
   Talking all day long.

   Look to a howling wind,
   Or to a hungry knife
   To find what writers and poets
   Use to show simulated life.
   What am I?

   Answer Choices:
   a. hyperbole
   b. gratification
   c. personification
   d. alliteration

   Correct Answer: **c. personification**

2. School: Warren Hills Regional Junior High
   Authors: D'Ana Reed, Robert Moyer, Jeremy Joblon, Mike Smith

   Question: At times I confuse; I'm difficult to construct; I hold a message. I contain a set of seventeen syllables which may be unique. I am a type of ancient Oriental art that shows emotions. What am I?

   Answer Choices:
   a. Tonka
   b. Lyric
   c. Blank verse
   d. Haiku

   Correct Answer: **d. Haiku**

3. School: Burlington City High School
   Authors: Jen Gitto, Kristian Kauker, Heather McConnell

   Question: I float through the air,
   But I cannot be seen.
   Though I may take a rest,
   I'll come right back.
   Don't call me flat,
   Though I might be blue,
   But not all the time.
   You should be able to guess me by now.
   What am I?

Answer Choices:
a. rhythm
b. pollen
c. melody
d. cloud

Correct Answer: **c. melody**

4. School: South Plainfield High School
Authors: Sophomore Cognetics Team

Question: My voice is played with fractions
I am written as flags and sterns.
I can be syncopation,
Or the counting of a band.
I am the drum that plays ta-tum-tum.
I am the heart beating lub-dub, lub-dub.
Do you know who I am?

Answer Choices:
a. balance
b. rhythm
c. tone
d. sound

Correct Answer: **b. rhythm**

YANKEE INGENUITY

A. BASIC LEVEL

1. School: Joyce Kilmer School
   Authors: Colin Fahey, John Rigsby, Scott Levine

   Question: Alfred Nobel created this to destroy buildings and make space for new things. What did he invent?

   Answer Choices:
   a. wrecking crane
   b. dynamite
   c. bulldozers
   d. shovel

   Correct Answer: **b. dynamite**

2. School: Logan Township Intermediate School
   Authors: Gregory Davis, Zamani Ma'ruf, Nick Stokolosa

   Question: The Indian name for barbed wire was _____.

   Answer Choices:
   a. killing wire
   b. sharp-toothed fence
   c. devil's rope
   d. cutting whip

   Correct Answer: **c. devil's rope**

B. INTERMEDIATE LEVEL

1. School: Kingsway Regional Jr. High School
   Authors: Kim Massinino, Gerry Micheal, Chezarae Rose, Shannon Verdieck

   Question: Car is to car-bra as ice cream is to _____ .

   Answer Choices:
   a. cookie wafer
   b. dish
   c. spoon
   d. chocolate syrup

   Correct Answer: **a. cookie wafer**

2. School: Leonard V. Moore School
   Authors: Rahim Alexander, Paula Vey, April Bauknight, Michelle Miller, Matthew Myers, Lynette Canady, Stacey Naused

Question: Jonas Stalk is to the polio vaccine as _____ is to the measles vaccine.

Answer Choices:
a. William Measles
b. Donald E. Wahlberg
c. Albert Einstein
d. John F. Enders

Correct Answer: **d. John F. Enders**

3. School: MacFarland Junior School
Authors: Shannon Lucas, Jennifer Nuel, Jaymee Romero, Sajani Shah, Dawn Sittinger

Question: Lightbulb is to lamp as needle is to _____.

Answer Choices:
a. syringe
b. pin cushion
c. sewing machine
d. haystack

Correct Answer: **c. sewing machine**

4. School: Buckingham Friends School
Authors: Jaime Ginsberg, Linnea Bradford, Blayne Wright, David Cohen, Kee Wrigley, Mark Wisse

Question: Horse is to saddle as bicycle is to _____.

Answer Choices:
a. bench
b. seat
c. chair
d. wheel

Correct Answer: **b. seat**

5. School: Herma S. Simmons School
Authors: Gillian Keys, Doug Bastow

Question: Airplane is to travel as _____ is to industry.

Answer Choices:
a. assembly line
b. steel
c. chemicals
d. cement

Answer: **a. assembly line**

C. ADVANCED LEVEL

1. School: Bordentown Regional High School
   Authors: Brian Applegate, Brian Guire, David McDermott, Brian Shestko, Joe Turak

   Question: You commit a sin—
   I'll shred your skin.
   Climb over me—
   I'll cut you in three.
   I could make your life end;
   I'm a guard's best friend.
   What am I?

   Answer Choices:
   a. pickett fence
   b. barbed wire fence
   c. chainlink fence
   d. none of the above

   Correct Answer: **b. barbed wire fence**

2. School: Rahway High School
   Authors: Chris Hardy, Janice Francis, Jeff Twaskas, Jennifer Canales, Ryan Alexander

   Question: I keep you dry all day and night;
   I protect you from an ugly sight.
   I come in colors, but mostly white,
   And I won't leak, if I fit tight.
   What am I?

   Answer Choices:
   a. raincoat
   b. bottle cap
   c. goggles
   d. disposable diaper

   Correct Answer: **d. disposable diaper**

ATOMIC CAFETERIA

A. BASIC LEVEL

1. School: Logan Township School
   Authors: Rae Heritage, Lesha Chaifetz, Shannon McCarthy, Gregory Beckett, Frank Cahill

   Question: What is the tiniest part of an element that can exist and still have the properties of that element?

   Answer Choices:
   a. molecule
   b. atom
   c. electron
   d. none of the above

   Correct Answer: **b. atom**

2. School: Shongum School
   Authors: Eric Gould, Chris Johnson, Eric Miller, Seth Shran, Jonathan White, Sunny Wong, Jack Levy, Becky Carlson

   Question: How many electrons are in a helium atom?

   Answer Choices:
   a. 40
   b. 10
   c. 2
   d. none of the above

   Correct Answer: **c. 2**

3. School: Merchantville School
   Authors: Rachel Levin, Sarah Skorupsky, Kristi Tropp

   Question: Atomic number tells how many _____ are in the _____.

   Answer Choices:
   a. protons - nucleus
   b. nuclei - electron
   c. neutrons - molecule
   d. electrons - nucleus

   Correct Answer: **a. protons - nucleus**

B. INTERMEDIATE LEVEL

1. School: Ryerson School
   Authors: Drew Helmholtz, Susy Davidson, Rob Walker, Kevin Toth

   Question: Oxygen is to human as carbon dioxide is to _____.

   Answer Choices:
   a. non-living matter
   b. plant
   c. animal
   d. water

   Correct Answer: **b. plant**

2. School: Kingston School
   Authors: Stacy Goldberg, Priti Panchal, Melissa Majikes, Jennifer Parroco

   Question: Red litmus paper is to baking soda as blue litmus paper is to _____.

   Answer Choices:
   a. bleach
   b. ammonia
   c. soda ash
   d. orange juice

   Correct Answer: **d. orange juice**

3. School: Judd Elementary School
   Author: David Schwanke

   Question: Proton is to positive charge as electron is to _____ charge.

   Answer Choices:
   a. battery
   b. neutral
   c. negative
   d. any

   Correct Answer: **c. negative**

4. School: The Academy, Wayne
   Authors: Craig McLauchlan, Josh Lowy, Jonathan Eisenstein, Eric Binder, Allen Yuhas, Les McCord

   Question: Calcium is to gypsum as _____ is to matches.

   Answer Choices:
   a. sulfur
   b. phosphorus

c. sodium
d. ash

Correct Answer: **a. sulfur**

C. ADVANCED LEVEL

1. School: Warren Hills Senior High
   Author: Ingrid Steiner

   Question: I burn in the air to form a pungent, colorless gas. I serve as an antiseptic, fungus-killer, a preservative for dried fruits. I am necessary in the manufacturing of wood pulp for paper. If I am combined with oxygen and water, I form what is perhaps the most versatile and useful acid known to people. What am I?

   Answer Choices:
   a. calcium carbonate
   b. sulphur dioxide
   c. ferric oxide
   d. potassium nitrate

   Correct Answer: **b. sulphur dioxide**

2. School: Bordentown Regional High School
   Authors: S. Borgstrom, B. Stahl, P. Looney, J. Diamond, P. Patel, C. Czarnecki, J. Toth

   Question: I am found in households throughout the world.
   I am very precious in some areas.
   I can be in the form of bars.
   I can make you shine.
   What am I?

   Answer Choices:
   a. soap
   b. baking soda
   c. gold
   d. ammonia

   Correct Answer: **a. soap**

3. School: Joyce Kilmer School
   Authors: Erik Boe, Jill Chiandusse, Drew Feust, Kate Hedman, Kristina Henkler, Rachel Layton, Erika Ravettine, Kristie Tippner

   Question: I'm a compound all shiny and transparent. I have six sides and when I'm perfect. I have a point. Who am I?

Answer Choices:
a. 0_2Si
b. Si0
c. Si_20
d. H_20

Correct Answer: **b. Si0**

5. School: Fernbrook School
Authors: Joseph Ferraro, Adam Doll, Tom Dolack, Brian Rothbart, Samir Shah

Question: My technical name is naphthalene; my molecular formula is 10 parts carbon and 8 parts hydrogen. What am I?

Answer Choices:
a. epsom salt
b. peroxide
c. rust
d. moth balls

Correct Answer: **d. moth balls**

INSIDE OUT

A. BASIC LEVEL

1. School: Joyce Kilmer School
   Author: Paul Hedman

   Question: How long does it take for food to digest?

   Answer Choices:
   a. 24 hours
   b. 2-5 hours
   c. 5-7 hours
   d. overnight

   Correct Answer: **b. 2-5 hours**

2. School: Joyce Kilmer School
   Author: Katie Williams

   Question: The pupil of the eye _____ when there is a lot of light.

   Answer Choices:
   a. becomes larger
   b. stays the same
   c. becomes smaller
   d. none of the above

   Correct Answer: **c. becomes smaller**

3. School: Clara Barton School
   Authors: Matthew Ryan, Christopher Bennett

   Question: What releases gastric juices in the stomach?

   Answer Choices:
   a. gastric juice door
   b. small intestine
   c. digestive glands
   d. liver

   Correct Answer: **c. digestive glands**

4. School: Clayton Elementary School
   Author: Ryan Cogan

   Question: Semi-circular canals in this organ give you balance.

   Answer Choices:
   a. bones
   b. liver

c. kidney
d. ear

Correct Answer: **d. ear**

5. School: New Albany School
   Author: Allan Polak

   Question: Which part of the brain produces the watery liquid called cerebro-spinal fluid?

   Answer Choices:
   a. choroid plexus
   b. dendrites
   c. capillaries
   d. crevices

   Correct Answer: **a. choroid plexus**

B. INTERMEDIATE

1. School: West Paterson Memorial School
   Authors: Holly Berdan, Stephanie Lucas

   Question: The heart is to circulation as the duodenum is to _____.

   Answer Choices:
   a. excretion
   b. breathing
   c. digestion
   d. reproduction

   Correct Answer: **c. digestion**

2. School: Ocean City Intermediate School
   Author: Alison Hooper

   Question: The bronchi are to the lung as the papilla are to the _____.

   Answer Choices:
   a. stomach
   b. brain
   c. ear
   d. tongue

   Correct Answer: **d. tongue**

3. School: Charles Street School
Authors: Kelly Dickinson, Deanna Rush, Matthew Monohan, Jodie Bartello, Jenna Marotta, Randy Johannsen, Steven Huston.

Question: Money is manufactured in a mint as the color in the eye is manufactured in the _____.

Answer Choices:
a. iris
b. pupil
c. cones
d. retina

Correct Answer: **c. cones**

4. School: West Deptford Middle School
Authors: Lisa Hill, Michelle Wall, Jamie Crawford

Question: Pyloric valve is to stomach as bicuspid valve is to _____ .

Answer Choices:
a. mouth
b. lungs
c. ears
d. heart

Correct Answer: **d. heart**

5. School: Crest Memorial School
Author: Mike Rago

Question: Right brain is to Harry Anderson as left brain is to _____.

Answer Choices
a. Dan Rather
b. Pee Wee Herman
c. Steve Martin
d. Alf

Correct Answer: **a. Dan Rather**

C. ADVANCED

1. School: Warren Hills Regional High School
Authors: Thomas Lawrence, Mike McGovern, Karen Snyder, Stephanie Miller, Ingrid Steiner, Marcia Tsai, Crystal Boddy

Question: My first is in bunny and also in bear.
My second's in heart and also in care.
My third on this paper is easily found.
My fourth is in king, but never in crown.

My fifth is in thank, but not in forgive.
My whole helps you breathe, eat, sleep, and live.
What am I?

Answer Choices:
a. National Wildlife Federation
b. brain
c. lungs
d. senseless riddle

Correct Answer: **b. brain**

2. School: Burlington City High School
Authors: Cognetics Team

Question:
I am an organ long and wide.
I'm in your mouth from side to side.
I can help you chew hour by hour.
Thanks to me you taste bitter, salty, sweet, and sour.
You know me well, but I'll help you guess.
Say the alphabet and stop at "S".
Without me you'd be a mime.
I help with that letter all the time.
What am I?

Answer Choices:
a. teeth
b. gums
c. tonsils
d. tongue

Correct Answer: **d. tongue**

3. School: South Plainfield High School
Authors: Freshman Cognetics Team

Question:
Without me you can't stand up straight.
I let you know when you must wait.
I pick up the dropping of a pin.
I'm not alone; I have a twin.
Many tools are inside of me,
My function is not easy to see.
I get pierced from time to time,
And I'm amused by a silly rhyme.
What am I?

Answer Choices:
a. ear
b. brain
c. eye
d. leg

Correct Answer: **a. ear**

4. School: Bordentown Regional High School
Authors: Brian Shestko, Brian Applegate, David McDermott, Brian Guire, Joe Turak

Question: I have a hammer, a stirrup too.
My drum picks up things said by you.
My anvil does not do much —
This part is for hearing, not for touch.
These are the things inside of me;
Now tell me please what can I be.

Answer Choices:
a. inner ear or labyrinth
b. middle ear
c. ear canal or meatus
d. hearing organ or organ of corte

Correct Answer: **b. middle ear**

5. School: Bordentown Regional High School
Authors: Scott Borgstorm, Craig Czarnecki, Jim Toth, Brian Stahl

Question: I move out; I move in.
I'm not connected to the chin.
You can see me, but you can't see past.
When the light goes on, I move very fast.
Could I be a, b, c, or d?
That is all the hints you'll get from me.
Who am I?

Answer Choices:
a. iris
b. cornea
c. pupil
d. retina

Correct Answer: **b. cornea**

JUST HEAVENLY!

A. BASIC LEVEL

1. School: Kellman Academy
   Authors: Neil Steinberg, Jon Adler, Michael Benn, Jaime Herndon, Shira Perlis, Michelle Rosenberg, Joselle Zand

   Question: What kind of eclipse occurs in the moon's penumbra?

   Answer Choices:
   a. partial
   b. total
   c. annular
   d. phase

   Correct Answer: **a. partial**

2. School: Madison Public Schools
   Author: Anne Gepford

   Question: The path the Earth takes around the Sun is called its _____.

   Answer Choices:
   a. rotation
   b. axis
   c. orbit
   d. equator

   Correct Answer: **c. orbit**

3. School: Ocean City Intermediate School
   Author: Holly Palermo

   Question: The greatest speed of the earth's rotation is perihelion, as the least (slowest) speed of the earth's rotation is _____.

   Answer Choices:
   a. hypohelion
   b. taphelion
   c. aphelion
   d. ergohelion

   Correct Answer: **c. aphelion**

B. INTERMEDIATE LEVEL

1. School: Franklin School
   Author: Palak Pandya

   Question: Ganymede is to Jupiter as _____ is to Saturn.

   Answer Choices:
   a. Phobos
   b. Titan
   c. Leda
   d. none of the above

   Correct Answer: **b. Titan**

2. School: Martin J. Ryerson School
   Authors: Sara Gardner, Shannon Ackermann

   Question: A starting line is the beginning of a race as the _____ is the beginning of spring.

   Answer Choices:
   a. vernal equinox
   b. blooming of flowers
   c. astronomical starting
   d. autumnal equinox

   Correct Answer: **a. vernal equinox**

3. School: Kingsway Regional High School
   Authors: Matthew Borzio, Michael James, Randy Hurst, Michael Cononica, Robert Kunkle, Ryan Lawler, Kate Fredericks

   Question: _____ is to Venus as 1.0 is to Earth.

   Answer Choices:
   a. .76
   b. .91
   c. .39
   d. 1.19

   Correct Answer: **b. .91**

A. BASIC LEVEL

1. School: Center Grove School
   Authors: Jeff Magnani, Tim Kaywork, Meredith O'Marra, Seema Desai

   Question: The first water wheel was used mainly to _____.

   Answer Choices:
   a. make electricity
   b. grind grain
   c. power steam engines
   d. make steam

   Correct Answer: **b. grind grain**

2. School: Merchanvtille School
   Authors: Patrick Brennan, Matthew Gilliss

   Question: Archimedes' Screw moves water from one place to another by _____.

   Answer Choices:
   a. vacuum
   b. turbulence
   c. water pressure
   d. turning blades

   Correct Answer: **d. turning blades**

3. School: Center Grove School
   Authors: David Kolibaba, Michael Weissman, Brian Stuelpner, Eric Rosenthal, David Lyon, Linnea Schiffner, April Coss

   Question: The first water-powered plant for generating electricity was built in what state?

   Answer Choices:
   a. Washington
   b. New York
   c. Wisconsin
   d. Wyoming

   Correct Answer: **c. Wisconsin**

B. INTERMEDIATE LEVEL

1. School: Ocean City Intermediate School
   Authors: Jason Hooper, Crystal Styers, Cathy Lavelle, Kasey Kiser

   Question: NASA's vertical axis generator is to St. Malo as wind is to _____.

   Answer Choices:
   a. geothermal
   b. tides
   c. nuclear fission
   d. nuclear fusion

   Correct Answer: **b. tides**

2. School: Kingston School
   Authors: John Potter, D. J. Marcucci, Matt Dunn, John Kontovrakis

   Question: Hot water is to dishes as _____ is to carpet.

   Answer Choices:
   a. dirt
   b. vacuum cleaner
   c. creme rinse
   d. fiber

   Correct Answer: **b. vacuum cleaner**

3. School: Valley Middle School
   Author: Chris Winberry

   Question: Water pressure is to water closet as air pressure is to _____.

   Answer Choices:
   a. airplane
   b. hot air balloon
   c. vacuum cleaner
   d. fan

   Correct Answer: **c. vacuum cleaner**

4. School: Chapel Hill School
   Author: Chris Porter

   Question: Windmill is to wind as _____ is to water currents.

   Answer Choices:
   a. anemometer
   b. hydroturbine
   c. water pump
   d. hydraulic pump

Correct Answer: **b. hydroturbine**

C. ADVANCED LEVEL

1. School: Bridgeton High School
   Authors: Greg May, Elvin Beardsworth, David McAllister, Brandon O'Mara

   Question: While eating Wheaties, Archimedes saw how they did float.
   He added a few more; the milk ran on the floor and he yelled this famous quote...

   Answer Choices:
   a. Oh, Gosh!
   b. Eureka!
   c. Wowee!
   d. Gnarly Dude!

   Correct Answer: **b. Eureka!**

2. School: Burlington City High School
   Authors: Philip Power

   Question: Many, many years ago,
   Although I could not float in air,
   I proved, if placed in the water flow,
   Some of my weight would seem to disappear,
   With an equivalent space that would displace
   As I rose to the surface at a steady pace.
   Who am I?

   Answer Choices:
   a. Newton
   b. Archimedes
   c. Pascal
   d. Bernoulli

   Correct Answer: **b. Archimedes**

3. School: Woodlynde School
   Authors: Paul W. Brundage

   Question: I wrote "Les Provinciales;"
   I am a Frenchman by name.
   I am a physicist by career,
   Physics and math, all the same!
   My teacher was Desargues, you see.
   My father was named Etienne.
   My mother died before my prime;
   My sister, a literary gem.
   I believed in H_2O, as a claim;

Lifting mass is it's trait.
Look it up in the "Traite Du Vuide."
Who am I? Tell me, I can't wait!

Answer Choices:
a. Frederic Joliet
b. Henri Becquerel
c. Blaise Pascal
d. Jean Foucault

Correct Answer: **c. Blaise Pascal**

WITCHES & WIZARDS

A. BASIC LEVEL

1. School: Aaron Decker Elementary School
   Authors: Michael Dudzak, Andrew Glinka, Theresa J. Scott, David Saus

   Question: Sand and iron filings together are an example of a _____.

   Answer Choices:
   a. chemical change
   b. mixture
   c. compound
   d. physical change

   Correct Answer: **b. mixture**

2. School: Frank Antonides School
   Authors: Michael Heayn, Andrew Ilvento

   Question: What is the symbol for copper?

   Answer Choices:
   a. C
   b. Co
   c. Cu
   d. Fe

   Correct Answer: **c. Cu**

3. School: Aaron Decker Elementary School
   Authors: Christine Bilello, Erin Capriel, Alyssa Dominianni, Alison Gulino, Matthew Harden, Kara Kroll, Daniel Madine

   Question: Alchemy was an early form of chemistry. It was a practice that combined _____.

   Answer Choices:
   a. science, religion, and magic
   b. science and nature
   c. science, art, and mathematics
   d. mathematics and art

   Correct Answer: **a. science, religion, and magic**

4. School: Merchantville School
   Authors: Tom Olchon, Josiah Van Sciver, Emily Wood, Brian Yan

   Question: Rust is an example of _____.

Answer Choices: a. H_2O
b. $FeCl_2$
c. $NaHCO_3$
d. Fe_2O_3

Correct Answer: **d. Fe_2O_3**

B. INTERMEDIATE LEVEL

1. School: A. C. Redshaw School
Authors: David Thomas, Shandon Scott

Question: Salad dressing is to emulsion as seawater is to _____.

Answer Choices: a. colloid
b. solution
c. suspension
d. immiscible

Correct Answer: **b. solution**

2. School: West Paterson Memorial School
Authors: Michele McGarrity, Tara Hunt, Michael Rubino

Question: Chromium is to green as cobalt is to _____.

Answer Choices: a. red
b. blue
c. yellow
d. white

Correct Answer: **b. blue**

3. School: Franklin School
Author: Danielle Ransom

Question: NaCl is to sodium chloride as KOH is to _____.

Answer Choices: a. carbonic acid
b. ammonium hydroxide
c. potassium hydroxide
d. acetic acid

Correct Answer: **c. potassium hydroxide**

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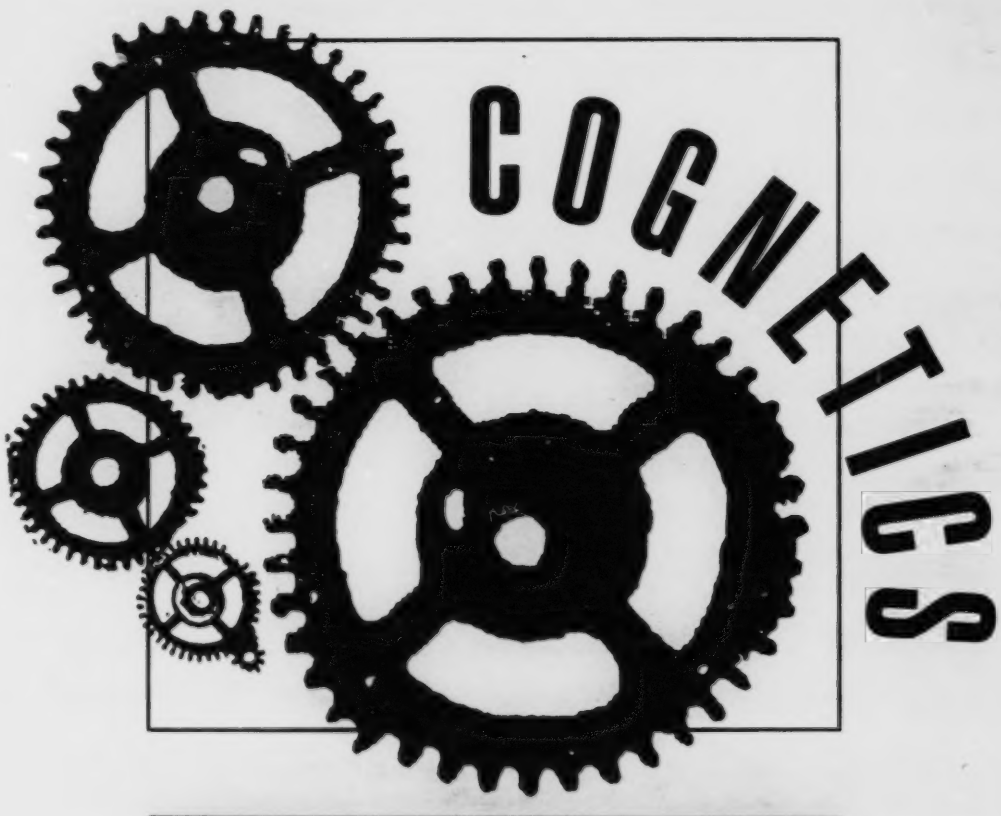
THINKING SKILLS ACTIVITIES IN INVENTIONS/ TECHNOLOGY AND SCIENCE



STUDENT MANUAL

JUDITH E. BURR, THEODORE J. GOURLEY AND REBECCA MCDONNEL

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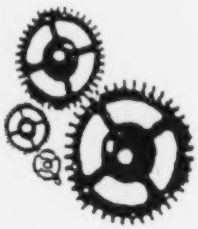

COGNETICS

Thinking Skills Activities in Inventions/Technology and Science

STUDENT MANUAL

by

Judith E. Burr
Theodore J. Gourley
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INTRODUCTION FOR STUDENTS

Since 1984, thousands of students, working in teams, have solved Cognetics problems as part of their school classes. Cognetics has introduced these students to research, cooperative learning, problem solving, and creative thinking.

Asked how they felt about Cognetics, students have responded positively. Many felt good about being able to come up with a good answer to a difficult question. Others enjoyed working in a team, sharing ideas with classmates, and making new friends. Some enjoyed learning in a different way. For instance, students working on "Atomic Cafeteria" were able to earn good grades in a chemistry course because of the work done on this Cognetics problem.

Cognetics problems are challenging and sometimes hard work, but they are also fun and satisfying. There are seven inventions/technology and seven science problems in this manual.

The pages that follow describe the seven parts of Cognetics problem, provide some useful problem-solving steps, and finally give some tips for presenting the solution.

THE PARTS OF A COGNETICS PROBLEM

- An **Introduction** which sets the scene and provides the fictional background for the problem.
- A **Problem Statement** which describes the general tasks to be accomplished in order to solve the problem.
- **Developmental Steps** which detail suggested activities and resources to use for researching and preparing problem solutions.
- A **Presentation** section which gives additional instructions on presenting the problem solution. Presenting the problem solution to an audience "tests" how well the team has solved the problem in a unique way.
- A **Debriefing** section which calls upon you to describe the process used to solve the problem and encourages the audience to ask questions about the presentation.
- A **Challenge to the Class** section which asks your team to develop questions for other students to answer about the problem. The Appendix to this manual contains challenge questions written by teams of students.
- An **Evaluation** which lists the most important aspects of the solution and presentation, for which you can receive points if the presentation is judged; bonus points are given for exceptional originality. Evaluation lets you know how well your team has solved the problem in the eyes of the objective judges.
- A **Bibliography** which suggests references that can be used to research the problem. Other materials can be added as well. School, home, and public libraries contain many reference sources on Cognetics topics.

PROBLEM-SOLVING STEPS

Problem-solving skills are essential for success with Cognetics problems.

a. **Gather the Facts**- What is the background for the problem? For each problem it is important to research the background enough to be able to make "educated guesses" about how to put information together.

b. **Define the Problem**- What is it that the team must do? A common mistake is to read more into a problem than is really required. Look at the following:

Design a robot which will move 10 feet, remove 3 ping pong balls from a box, put the balls into a bag, return to the starting place with the bag of balls, and signal when it is done.

Then answer these questions:

- Must the robot walk? (no)
- Must the robot pick up the balls? (no)
- Must the robot hold the bag? (no)
- Must the robot talk? (no)

c. **Analyze the problem**- What are the subproblems which must be solved? Return the robot problem example above. Break the problem down into subparts. Check your list against the list below.

- The robot must more a distance of 10 feet.
- The robot must remove 3 ping pong balls from a box.
- The robot must place the ping pong balls in to a bag.
- The robot must move 10 feet back to the starting place.
- The robot must signal when finished.

d. **Generate Ideas**- How might the subproblems listed above be solved? Think of ideas for each of the subparts for the robot problem. For example, how will the robot move a distance of 10 feet?

- roll
- walk
- fly
- be dragged

e. **Elaborate Ideas**- Select one of the subparts under c. (i.e. the robot must move a distance of 10 feet) and think of a way to accomplish this task (i.e. put the robot on roller skates). Think about what the skates and the robot might look like. What colors would they be? What materials could they be made of? What special features could be added to start or stop the robot? All of these additional ideas are part of "elaborating" your solution. Elaboration makes your solution effective, unique, and creative.

f. **Select a Solution**- Which of the elaborated ideas will actually solve the problem? Develop criteria by which to judge the merits of the ideas. Using these criteria, one idea can be selected for a tryout.

g. **Elaborate the Solution**- What additional details must or can be added to develop the solution to make its meaning or theme clear, add to its beauty or uniqueness? Generate ideas to enhance the solution and develop the solution into a final product.

TIPS FOR PRESENTATION

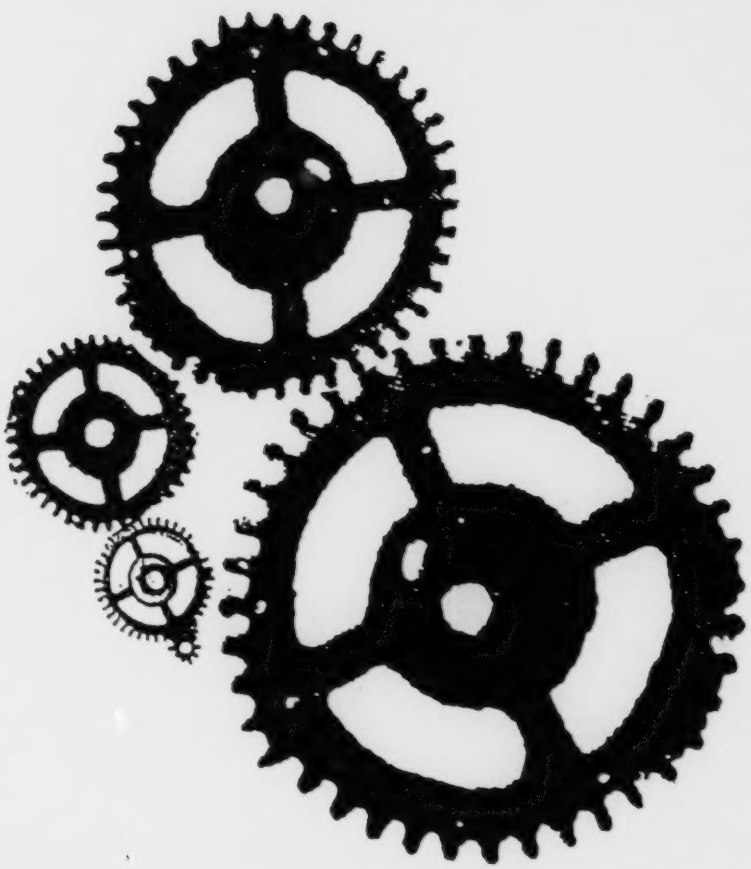
- Note the length of time allowed for presentation. (This time includes set up and removal of props.) Be sure to practice your presentation so that everyone on the team knows his or her part in the presentation well. The team should work as a smooth unit.

- Once the basic solution has been chosen and the presentation has been planned think of special ways to make the presentation unique. Costumes, details of setting, music, and humor can all make the presentation more enjoyable.

- Be sure the audience can see and hear everything that's being done in the presentation. The audience can appreciate a team's solution only if what's being said and done is clear.

- Have someone who has not worked with your team evaluate one of your dress rehearsals. This judge can help your team by suggesting things that are not clear, can't be heard or seen, etc.

Inventions/Technology Problems



COMMOL

BY THEODORE J. GOURLEY

Introduction

Dr. Lesly Tenthse, the director of research and development of the Neuro-Psychological Institute at the State University, has recently announced a discovery which could greatly reduce anxiety, depression, and many of the mental and physical "diseases" which are stress-related. The research was conducted under a grant from Mer-Ker Jones Corporation. That corporation is now preparing to sell a new product based on Dr. Tenthse's discovery. This new product will be called Commol, and 25% of the profits from its sales will go to fund further research at the Neuro-Psychological Institute. You and your colleagues work in marketing and advertising for the Mer-Ker Jones Corporation. It is your responsibility to design the advertising for this new product.

PROBLEM STATEMENT

Design and produce the print and broadcast materials to sell Commol, a new product to reduce stress. The materials to be designed and produced are a 60-second videotaped T.V. commercial*, a 30-second audiotape for a radio commercial, a 150-word press release, and an 8½" by 11" magazine advertisement.

DEVELOPMENTAL STEPS

1. Study the effect of stress on physical and mental health. Find out which diseases are associated with stress.
2. Create your product, Commol. What is it? What effects does it have? How is it used? Why does it work?
3. Obtain and study press releases. How are they written, what tense, what person, etc? What needs to be included in a press release? Develop a 150-word press release on your product.
4. Study ads in magazines to decide which are more appealing for Commol: drawings, photos, slogans, etc. Talk to artists, writers, and photographers who have worked on ads. Develop an 8½" by 11" advertisement for a magazine.
5. Obtain technical help from someone who is experienced in making audio and videotapes. This individual should teach the team how to produce their own tapes for Cognetics, not produce the tapes for them.
6. Record and study radio commercials. What elements would be most appropriate for Commol? Develop a 30-second commercial for radio. The commercial is to have:
    - background music
    - sound effects
    - dialogue.

* If video equipment is not available, a skit may be substituted.

7. Develop a 60-second videotape to be used for a T.V. commercial. (If video equipment is not available, a live skit may be substituted.) The commercial must:
    - have an original jingle (words and/or music)
    - show the product
    - describe how the product is to be used
    - make it clear what the product is (i.e., pill, food, place, etc.)
    - make it clear what the product does (i.e., its effects upon the user).

8. Develop the elaboration necessary to make this a unique, creative production.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. The team should present copies of the press release and the magazine ad to the judges.
3. The team should then present the radio commercial. (Two presentations may be necessary to allow the judges adequate time to evaluate it.)
4. Then, the team should present its television commercial. (Two showings may be necessary.)
5. Finally, a team spokesperson should read the press release and show and describe the magazine advertisement to the audience.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions which require naming those diseases which are believed to be stress-related.

EXAMPLE: An example of a stress-related disease is _____ .
a. mumps
b. measles
c. hives
d. pneumonia

ANSWER: c. hives

Intermediate: Teams prepare and ask questions about the relationship between stress and certain diseases. The questions should be written as analogies.

EXAMPLE: Bacteria is to infection as _____ is to an ulcer.

a. garlic
b. divorce
c. milk
d. promotion

ANSWER: b. divorce

Advanced: Teams prepare and ask questions about the relationship between stress and certain diseases. The questions should be written as riddles.

EXAMPLE: I come with butterflies.
I leave with knots.
I'm the subject of song—
But the problems I cause
When things go wrong!
Who am I? What do I cause?

ANSWER: Love causes anxiety.

EVALUATION

Points Received		Possible Points
____	1. The team has designed a press release.	15
____	2. The team has designed a magazine ad.	15
	3. The team has produced a radio commercial.	
____	• The commercial has background music.	5
____	• The commercial has sound effects.	5
____	• The commercial has dialogue.	5
	4. The team has produced a T.V. commercial.	
____	• The commercial has an original jingle.	5
____	• The commercial shows the product.	5
____	• The commercial describes product's use.	5
____	• The commercial clarifies nature of product (pill, food, etc.).	5
____	• The commercial clarifies effects of product on user.	5
____	5. Debriefing showed understanding of the problem and solution process.	10
____	6. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	7. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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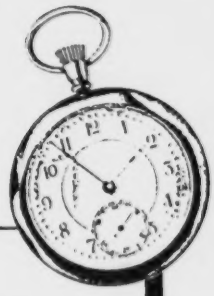
NOTES

CONTRAPTION

BY ELVIRA R. BROWN



Introduction

There are those who wonder so much about what makes things tick that they will take apart a watch to examine its gears. Then there are those who only wonder if their watch has the correct time.

A native of New Hampshire once explained the custom of people in his region to "walk a look." A person would look as far out on the horizon as possible, pinpoint some spot, then walk there, enjoying the beauty of all that could be seen during the journey.

As we allow ourselves to wonder, we are mentally "walking a look." In the process, we discover many things. It was in the year 1550 that the Italian mathematician Geronimo Cardano used his mind to walk a little further than "a look." He saw a solution for which there wasn't even a problem yet. It wasn't until 275 years later, when people were searching for a means of transferring power from a steam engine to the wheels of a carriage that the Cardano coupling, now known as the universal joint, was first used.

PROBLEM STATEMENT

Design a solution to a problem of the far-off future, then build a working contraption and demonstrate its use. Incorporate the use of gears, a pulley, and a lever and fulcrum. Then, design a trade symbol or logo for the contraption and three visual applications of the symbol. Develop a presentation of your creations.

DEVELOPMENTAL STEPS

1. Examine gears, pulleys, and levers that are used in common contraptions, such as bicycles, industrial mills, cars, toys. Learn how they function and relate to one another.
2. Look up the word "prototype." Your team will be responsible for making a working machine that actually performs a function. For example, if you are making a futuristic popcorn popper, your contraption should actually produce popped corn.
3. Identify possible problems of the future. A good way to track your thinking as you "walk further than a look" is to record all ideas on a future's wheel. For instance, write down a problem idea, then link in diagram form the many different and unusual effects that may result from the problems.
4. Select a problem and design a contraption that will solve it. For example, a way to solve the garbage problem might be to develop a trash can fitted with its own compactor, incinerator, and air filter so that, from start to finish, the trash is contained, processed, and released in a harmless form. The contraption should be drawn on blueprint, with all parts clearly labeled.
5. Build a working model of the contraption, using gears, a pulley, and a lever and fulcrum.

   NOTE: As with all Cognetics solutions no open flames, caustic chemicals, or otherwise potentially hazardous materials may be used.
6. In order to successfully market the product, team members need to advertize the contraption. Design a trade symbol or logo which describes either the activity (e.g., agriculture), production

site (e.g., spinning wheel), product (e.g., hats), holiday or festive occasion (e.g., weddings). Then, design visual examples of the use of the symbol or logo for three of the following five:

- announcement
- advertisement
- trade card or menu
- envelope
- business form.

7. Develop and practice a presentation of your contraption and advertising. The presentation should be in skit form; costumes and props may be used.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and cleanup.
2. A team member should describe the future problem which needs to be solved.
3. The contraption should be displayed to the audience. One member should act as the "Cardano" of the group, using the blueprint to explain the contraption with all its parts (gears, pulley, etc.).
4. Then, some members should represent the people in the future who build the first practical application of the solution.These members will demonstrate the contraption, explaining how the gears, pulley and lever function together to make the product work.
5. Finally, one member should give a marketing pitch, explaining the relationship of the trade symbol and applications to the contraption.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about machines.

EXAMPLE: A bar for raising a weight at one end by pushing down at the other end is a _____.

a. force
b. lever
c. fulcrum
d. gear

ANSWER: b. lever

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Intermediate: Teams prepare and ask questions about the relationship between a machine and its parts. The questions should be written as analogies.

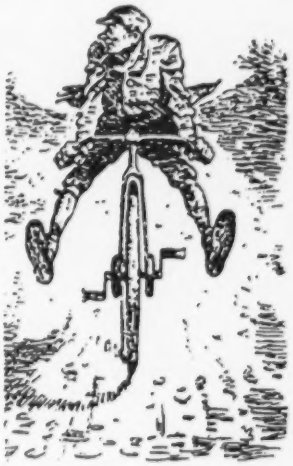
EXAMPLE: A _____ is to a mechanical clock as the quartz crystal is to a quartz clock.
a. pendulum
b. sundial
c. winding key
d. spring

ANSWER: a. pendulum (The vibrations of both control the speed of the clocks.)

Advanced: Teams prepare and ask questions about the relationship between a machine part and its function. The questions should be written as riddles.

EXAMPLE: I'm a study in contradiction,
But not a work of fiction.
Covered in grease
To keep me clean.
Right in a face,
But never seen.
I bite, but don't swallow—
Are you beginning to follow?
What am I?

ANSWER: gear



(SEE FOLLOWING PAGE FOR EVALUATION AND BIBLIOGRAPHY.)

EVALUATION

Points Received		Possible Points
____	1. A possible problem of the future was identified.	15
____	2. A blueprint was displayed and explained with all parts clearly labeled.	20
	3. A contraption was demonstrated with explanation of how parts function. The contraption:	
____	• uses gears	5
____	• uses pulley	5
____	• uses lever and fulcrum	5
____	• works.	5
	4. Packaging and logo were displayed and relationship to the product is explained. Visuals were presented for *three* of the following (5 points for each visual **up to 15**):	
____	• announcement	5
____	• advertisement	5
____	• trade card or menu	5
____	• envelope	5
____	• business form	5
____	5. Debriefing showed understanding of the problem and solution process.	10
____	6. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	7. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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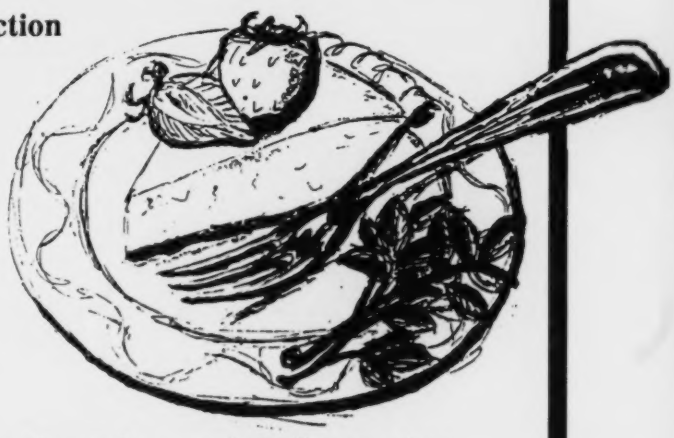
NOTES

FEED ME

BY JUDITH E. BURR

Introduction



The meat won't cut.
The soup will drip.
The milk will spill.
Spaghetti slips.
The ice cream melts,
Right down your hand.
And those adults—
They think it's grand
To have a knife and fork and cup
And spoon and bowl
From which to sup.

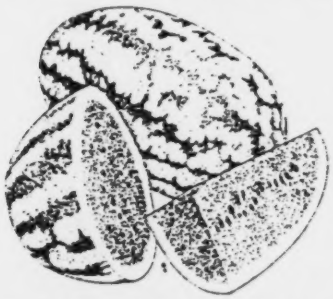
Yes, indeed, getting food from table to mouth can be a real challenge when you're limited to traditional American utensils and tableware. Not only do you end up wearing food, or burned, or frozen by it, but you run the risk of starvation, with half your meal falling to the floor.

PROBLEM STATEMENT

Design a better way to consume food or drink that does not involve a standard knife, fork, spoon, glass, bowl, or plate; is safe to use regardless of the food's temperature; allows the diner to "capture" the food or drink effectively; excludes the direct use of fingers as a utensil. Then, develop a skit in which a diner demonstrates the use of the new method.

DEVELOPMENTAL STEPS

1. Discuss the problems a person might have when eating or drinking at home, school, a restaurant, or a special event (party, ballfield, beach, etc.).
2. Review the list of foods and drinks below. What are some potential problems with consuming each? What problem foods or drinks would you add to this list?



FOOD AND DRINK LIST

honey	watermelon
butter	ice cream
hot soup	fried eggs
spaghetti	salad with dressing
noodles	ketchup
oranges	Kool-Aid (from a pitcher)
chicken legs	drink with crushed ice
steak	peas

3. Bring in samples of cutlery, tableware, and food or drink containers from home and examine their variations. What difficulties in getting food or drink from table to mouth were their manufacturers trying to prevent?

4. Read about different eating customs in today's cultures, and how these customs have changed throughout history.
5. Pick one item from the "Food and Drink List" and discuss the problems that arise when trying to consume this item.
6. Develop a method for getting your chosen item from table to mouth. The method should solve the problem or problems you have already identified. Give your method a name. The method should not use standard utensils in a traditional way or fingers as utensils, should be safe, and should capture food effectively.
7. Develop and practice a short skit in which a diner and whatever additional characters (team members) you invent will describe to the audience the problems traditionally encountered when trying to consume the chosen food or drink. Then demonstrate the solution, using the actual food or drink. Remember to include features that will make your solution colorful, interesting, and unique.
8. Plan to invite a member of the audience to use your method as part of the skit. Be creative in the role you ask the person play.

PRESENTATION

1. The team has 10 to 15 minutes for set up, presentation, and clean-up.
2. The team should present the skit, featuring a diner and other characters, to describe the problems traditionally encountered in consuming the chosen food, and to demonstrate the problem solution.
3. The team should then select a member of the audience to play the diner or another role.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about specific cutlery, tableware, or containers and their functions.

EXAMPLE: A finger bowl is a _____.

a. tiny dish the width of a finger in which expensive cooking spices are kept
b. long, narrow dish shaped roughly like a finger
c. basin to hold water for rinsing fingers at the table
d. bowl from the Finger Lakes

ANSWER: c. basin to hold water for rinsing fingers at the table

Intermediate: Teams prepare and ask questions concerning parallel utensils in different cultures, or utensils performing the same function over time. These questions should be written as analogies.

EXAMPLE: Fingerbowls are to the 19th century as _____ are to the 20th century.
a. fingerfoods
b. paper napkins
c. moist towelettes
d. spice racks

ANSWER: c. moist towelettes

Advanced: Teams prepare and ask questions regarding specific cutlery, tableware, or containers and their functions. The questions should be written as riddles.

EXAMPLE: I pull food up;
I slide it down.
I'm long and thin,
But also round.
I do like liquids,
Pieces, too,
But they must be too small to chew.
I'm fun to use.
Can you guess who?

ANSWER: a drinking straw

(SEE FOLLOWING PAGE FOR EVALUATION AND BIBLIOGRAPHY.)

EVALUATION

Points Received		Possible Points
____	1. A food or drink item was chosen from the list.	10
____	2. A better way to consume the item was designed; this method:	
____	• does not use a standard utensil	10
____	• is safe to use	10
____	• is effective	10
____	• does not use fingers as a utensil.	10
	3. The new method was presented in a skit which:	
____	• described the problems traditionally encountered	10
____	• demonstrated the solution.	10
____	4. Debriefing showed understanding of the problem and solution process.	10
____	5. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	6. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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NOTES

IT'S IN THE MAIL

BY ELVIRA BROWN

Introduction

In our day of express mail, next-day service, and front-door delivery of parcels, we have come to take the mail service for granted. In the Pony Express days, people never thought airmail possible; it was something for science fiction books.

Come with us to the future, to the year 2087, when "airmail" really means airmail. Mrs. J-X14 is once again on the video-phone trying to explain what happened to the 2000 MPH Zoom payment that she recently mailed.

Your mission, should you choose to accept it, is to devise a means of getting mail to its destination almost immediately. Remember that there are a variety of things that could cause any piece of mail to be delayed. Include some kind of fail-safe measures to ensure delivery.

PROBLEM STATEMENT

Design a way to transport objects from one location to another through thin air at great speeds and with total accuracy, and present your solution in a skit. Your future mail system should transport objects through the air, suggest a post office of the future, and include a fail-safe system that can catch an article that is in danger of being lost in the mailing process.

DEVELOPMENTAL STEPS

1. Trace the origin of mail delivery in this country starting with the Pony Express days. Identify unsung heroes (people) and depots (places) of the past.
2. Explore the period of railroad development when East literally met West. Also, investigate the beginnings of air and sea travel and their adaptations for commercial cargo. These will lead you to the mail system that developed as a result of technology. Then consider other advances in technology that might usher in a future era of postal delivery.
3. Interview employees of your local post office. Visit a service center that ships at great speeds such as UPS, Express Mail Service, Federal Express.
4. Examine the methods used to safeguard property while transporting large quantities of it. Learn about registering mail, requesting return receipts, and having armored guards ride with the mail.
5. Visit a drive-in bank that has remote windows and explore the system of sending objects, up, over, and down chutes. While you're examining how parcels travel, consider also how nature transports seed pods, such as the maple tree seeds that flutter overhead, fly horizontally, and land far away from their original point of departure.
6. Find out what happens to mail that cannot be delivered. Look for obscure facts about messages that were delivered against all odds—notes in bottles that reached distant shores, 50-year-old waylaid letters. . . .

7. Design and construct an airmail system which:
    - can be used by any member of the public
    - can transport mail from the size of a post card to a manila envelope weighing up to 6 oz.
    - activates signals in 4 different locations to show where the mail is in the system
    - has at least one airmail link, where mail is transported, or appears to be transported between 2 points through the air.
8. Draw a schematic or blueprint of your airmail system.
9. Make your post office real by filling it in with details—set, costumes, props, and write a skit to demonstrate how it would be used on a particular day. Remember to include special features that will make your presentation colorful, interesting, and unique.

PRESENTATION

1. Each team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. The team should present their schematic or blueprint to the judges and explain it to the audience, i.e., how the system should work.
3. The team should then demonstrate the system via their skit.
4. After one successful run, an audience member should be selected to test the mail system.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about technology and communication.

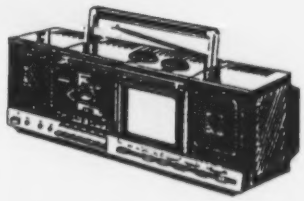
EXAMPLE: Letters going to the following country may be sent by airplane for fast service or by underwater pipelines for less expensive service.

a. England
b. Germany
c. Denmark
d. None of the above

ANSWER: d. None of the above (Underwater pipelines have not been developed for mail service.)

Intermediate: Teams prepare and ask questions regarding the relationship between technology and communication. The questions should be written as analogies.

EXAMPLE: *Radio is to sound, as _____ is to picture.*
a. wireless
b. satellite
c. T.V.
d. stereo



ANSWER: c. T.V.

Advanced: Teams prepare and ask questions about specific technology and communication. The questions should be written as riddles.

EXAMPLE: I get my start from earth, wind, and fire.
My message is for all to see—
The eagles of the air,
The buffalo of the plains.
Yet few understand.
What am I?

ANSWER: smoke signals

EVALUATION

Points Received		Possible Points
____	1. A mail system schematic or blueprint was presented and described.	10
	2. An airmail system was demonstrated which:	
____	• can be used by any member of the public	15
____	• can transport mail from the size of a postcard to a manila envelope	15
____	• has signals that can be activated in 4 different locations to show where mail is in the system	15
____	• has at least one link where mail is transported, or appears to be transported, through the air.	15
____	3. Debriefing showed understanding of the problem and solution process.	10
____	4. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	5. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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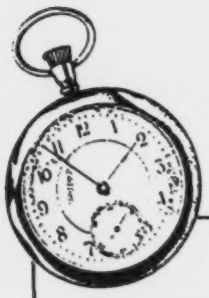

OOO-AHH-AAA!

BY THEODORE J. GOURLEY

Introduction

A few minutes of action on the movie screen involves months of conceptualization, writing, planning, designing, and organizing people and materials. The classic scenes in **Star Wars** become even more spectacular when one sees the P.B.S. television show "The Making of Star Wars." Each scene involving special effects started with an idea, then a written description, followed by an analysis of the problem and numerous designs and tests before the producers found the right solution. This is the creative problem-solving process.

Many of these special effects sequences are produced by small, specialized studios. The large studio which is making the picture may contract with one of these small specialty studios for specific scenes or effects.

You and your colleagues have formed a small special effects film company. You are interested in acquiring contracts with major studios, but you are unknown. However, you have a chance to demonstrate your ability at the upcoming Film Technology Exposition, sponsored by the Modern Art Museum and the Consortium of Motion Picture Producers. All you need to do is to create a two-minute sample of your work to exhibit at the Exposition.

PROBLEM STATEMENT

Design and produce an original two-minute videotape presentation* which uses props, special effects, or natural settings to convey the impression of another environment or location; creates or dramatically changes a main character (human or other life form) which will interact with the other characters or environment; and creates the appearance of danger to the characters.

DEVELOPMENTAL STEPS

1. Critically examine movies and T.V. shows that use special effects. Some examples are **2001: A Space Odyssey**, **Star Wars**, **Goonies**, **Gremlins**, **Indiana Jones**, and **Ghostbusters**.
2. Study how special effects are created. In addition to using the books listed in the Bibliography, you can consult the **Reader's Guide to Periodical Literature** under "Motion Pictures Special Effects." This source lists special effects articles which have appeared in **Theater Craft**, **Newsweek**, **Omni**, **Popular Mechanics**, and many other magazines.
3. Obtain technical help from someone who is experienced in film or video productions. This help is to teach you how to produce your videotape, not produce the tape for you.
4. Formulate the story line and script for your video presentation, including setting, dialog, action, characters, etc. Create special effects which enhance the presentation. Be sure to include a novel environment, a main and other characters, and danger.
5. Practice and tape your two-minute presentation.

* If video equipment is not available, a skit may be substituted.

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PRESENTATION

1. Each team has 10 to 15 minutes for set-up, presentation, and clean up.
2. A team member should introduce the video.
3. Each video should clearly show special effects through the environment, a human or other life form that interacts with other characters, and the appearance of danger.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about inventions and/or inventors that have affected entertainment in the past 100 years.

EXAMPLE: _____ invented the motion picture.

a. Thomas Edison
b. Henry Ford
c. Orville Wright
d. Samuel Goldwyn

ANSWER: a. Thomas Edison

Intermediate: Teams prepare and ask questions about the relationship between entertainment and technology in the last 100 years. The questions should be written as analogies.

EXAMPLE: The film is to movies as wax was to _____.

a. museums
b. records
c. movies
d. carnivals

ANSWER: b. records (Phonograph record masters were printed on wax.)

Advanced: Teams prepare and ask questions about the relationship between technology and entertainment in the last 100 years. The questions should be written as riddles.

EXAMPLE: Is it me or someone else?
My voice stacks on the shelf.
My name suggests metallic,
Although I'm really synthetic.
And with me you can make beautiful music
With no lessons at all.
What am I?

a. brass instrument
b. magnetic tape
c. kazoo
d. radio

ANSWER: b. magnetic tape

EVALUATION

Points Received		Possible Points
____	1. A video or skit using special effects was produced.	30
____	2. The video or skit was appropriately introduced.	10
____	3. The video or skit uses props, special effects or natural settings to convey the impression of another environment or location.	10
____	4. The video or skit uses a main character who interacts with the other characters.	10
____	5. The video or skit creates the appearance of danger to the creature and/or characters.	10
____	6. Debriefing showed understanding of the problem and solution process.	10
____	7. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	8. Bonus points for elaboration and creativity.	10
____	**TOTAL**	100

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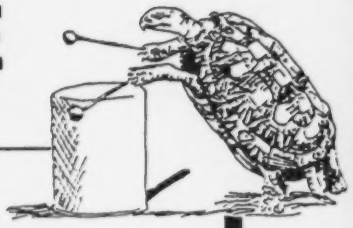
STRIKE NOTICE



BY TERRY MCELROY

Introduction

By an overwhelming "yes" vote, the combined membership of AFTRA (American Federation of Television and Radio Artists), SAG (Stage Actors Guild), and AFM (American Federation of Musicians) authorized a strike against the producers of musical videos.

You are the owner of the famous music video agency, Dynamic Visuals and Sounds, Inc. During the strike, MTV, VH-1, the Black Entertainment Network, and other video stations must fill their air time, but they may not use any existing tapes. These stations do not want to lose their vast viewing audience. They want to keep those who like acid rock, soft rock, country and western; they also want to keep those who like classical, easy listening, and show music. They demand originality and a variety of themes and moods. Your job is to supply an original three-minute music video without the use of live actors, singers, or musicians—or traditional instruments.

PROBLEM STATEMENT

Produce a three-minute music video which has a theme, melody, and lyrics.* The melody must be composed of sounds created by any means other than the use of traditional musical instruments; however, such instruments may be used in an unconventional way.

DEVELOPMENTAL STEPS

1. Research the history of musical composition. Study the families of instruments, their sounds, and their construction.
2. Look for sources of sound all around you. Make a list of the producers of sound in your everyday environment.
3. Find out about poetry and compare forms and styles. Evaluate various types of music lyrics as they relate to poetic forms and styles.
4. Research film, video, sound, and lighting methods.
5. View and discuss the use of sound and visual techniques in music videos, puppet shows, cartoons, commercials.
6. Decide on the subject, or theme, of your video. The subject could be a person, place, or thing in your school or elsewhere; it could be anything songs are written about. Pick something interesting to your team and the class.
7. Write lyrics to describe your subject. The lyrics can tell a story, make a joke, or just be aesthetically pleasing.
8. Decide how will you create sounds to communicate the subject and accompany the lyrics.
9. Create the visual elements to go with your "sound track." Your visual representation must correspond to the musical theme. It can include anything but humans "on camera."

*If video equipment is not available, a live skit may be substituted.

10. Put it all together in a three-minute visual presentation. The video must include balance and mood, and be interesting. Humans may not be seen. Practice your presentation, then tape it.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. A member of the team should introduce the video (or skit).
3. The video may be shown a second time so that the audience can note the elements of balance, color, tone, and value.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about the techniques used in music, poetry, or visual arts to modify an artistic element.

EXAMPLE: What quality of a color have you changed when you add white to any color of paint?
- a. value
- b. texture
- c. form
- d. accent

ANSWER: a. value

Intermediate: Teams prepare and ask questions about the techniques used in creating elements involved in music, poetry, and visual arts. The questions should be written as analogies.

EXAMPLE: Repeating a series of long and short sounds is to rhythm in music as repeating a series of large and small _____ is to rhythm in art.

- a. colors
- b. shapes
- c. tones
- d. accents

ANSWER: b. shapes

Advanced: Teams prepare and ask questions about techniques used in music, poetry, and visual arts. The questions should be written as riddles.

EXAMPLE: You can find me in nature.
The deer know my trick.
The clocks know my secret,
With their tock tock tick tick.

Artists, composers, writers of verse
Use me, use me, use me
Till I feel I might burst,
Till I feel I might burst.

What am I ?

ANSWER: repetition

EVALUATION

Points Received		Possible Points
	1. A video or skit was produced which contains:	
____	• a theme	10
____	• melody	10
____	• lyrics.	10
____	2. The musical composition uses sounds created by non-traditional "instruments."	10
	3. The video or skit includes:	
____	• balance	10
____	• mood	10
____	• interest value	10
____	4. Debriefing showed understanding of the problem and solution process.	10
____	5. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	6. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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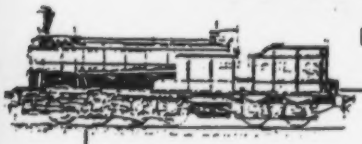
NOTES

YANKEE INGENUITY



BY JUDITH E. BURR AND THEODORE J. GOURLEY

Introduction

Walt Disney's **Ben and I** provides an entertaining look at both the creative, playful mind and practical, analytical voice which live symbiotically in a great inventor. In this case, the inventor is Ben Franklin and the analytical voice is one Amos Mouse. It is Amos who guides the ordinary Franklin to discover many great things and ideas through often simple suggestions. In one sequence, Amos points out to the freezing Ben that he wouldn't be so cold if all his heat wasn't going up the chimney. The result was the Franklin stove.

The real Ben Franklin's ideas went beyond warming the citizen to inflaming the spirit of a nation. The year 1776 gave birth to the American Revolution; then, the 1787 Constitutional Convention in Philadelphia gave birth to the American nation. Ben's skills figured strongly in that convention, and, as that summer's decisions were implemented, our government came to life.

PROBLEM STATEMENT

Choose one problem represented by the inventions on the list below. Then, study an invention which has solved the problem in the past and create a new invention to solve this problem even more effectively in the 1990's.

INVENTIONS LIST

- **Clothing**
  Safety pin, velcro, rubber rain coat, zipper, disposable diaper, nylons, space suit, work shoes, rain gear.
- **Communication**
  Videocassette recorder (VCR), color TV, typewriter, computer, telephone, telegraph, communications satellite, mimeograph, instant camera, polygraph, radio astronomy.
- **Food, Nutrition, and Cooking**
  Tang, Mason jar (canning), refrigeration, ice cream cone, freeze dry process, infant formula, hybrid corn, microwave oven, combine harvester, herbicide, condensed milk, milking machine.
- **Health & Medicine**
  Polio vaccine, contact lens, cellbank, iron lung, pacemaker, heart-lung machine, artificial heart and valves, measles vaccine, human blood groups, dental chair and dental drill, bifocals, genetic code.
- **Housing & Domestic Convenience**
  Mosquito netting, solar panel, flush toilet, vacuum cleaner, electric light, air conditioner, trundle bed, carpet sweeper.

(Continued on following page)

- **Transportation**
  Airplane, carriage, steamboat, motorcycle, helicopter, in-flight refueling, pullman car, liquid fuel rocket.
- **Other** (services, processes, materials, systems)
  Pony Express, plastic, Teflon, public education, vulcanized rubber, atomic clock, barbed wire, cash register, direct current electric motor, infrared photography, laser, lightning rod, mass production process, solar battery.

DEVELOPMENTAL STEPS

1. Contact museums, historical commissions, historical sites, and libraries to find what displays and written materials they have on American inventors and inventions.
2. Find out about American inventors and their inventions. Don't be surprised to learn that some items were invented simultaneously, repeatedly, or by immigrant inventors (with ties to the U.S.A. and other countries). Consider not just invented objects like the airplane, but systems and procedures which Americans have devised to solve their problems: the Pony Express, flooding cranberry bogs to harvest the berries, food stamps.
3. Read about the development of such major inventions as the steam engine, for which several persons claimed credit.
4. Examine the definitions for patent, trademark, copyright. To what rights (and responsibilities) does each entitle the holder? What must the holder do to obtain these certifications?
5. Sometimes it is the gadget of everyday need which has the greatest impact on society—imagine your life without pencils, zippers, or Kleenex! To help your team narrow its thinking about inventions and problems, look around your classroom, the school cafeteria, the nurse's office, the gym. What articles (or procedures or systems) are used which have evolved from others (computer-pencil/paper-chalk/slate). How could these solutions still be improved upon?
6. Decide on the problem you will solve. How has the problem changed over time? What inventions have helped with this problem? What kinds of improvements could be made?
7. Think about the 1990's invention which your team will create, and discuss what is meant by "current breakthroughs" and "emerging technologies." Two "hot" examples you might review are super-conductors and genetic engineering. Examine current magazines that feature news about American (or global) problems that are being solved. Sources to consider include **Omni Magazine** and the science/technology section of **Time Magazine**.
8. Create an invention. Design it in schematic (blueprint) form or write description of it. Then build a functioning model of at least part of the invention.
9. Develop a skit around the problem to be solved, the old invention, and your team's new one. Be sure to include the advantages of your new invention.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. The team should present its schematic or written description to the judges.
3. The team should state the problem to be solved and then demonstrate the old invention and new one in a skit form.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.

2. The team should describe the special (distinguishing) elaboration features included in their presentation.

3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.

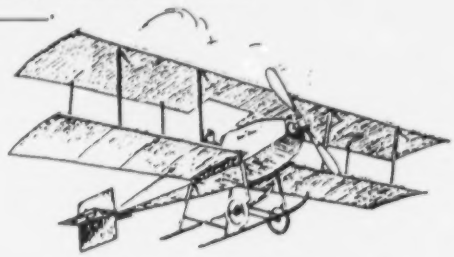
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about American inventions and their functions.

EXAMPLE: The Wright Brothers' experiments at Kitty Hawk resulted in Americans being able to _____.

a. swim
b. sail
c. fly
d. type



ANSWER: c. fly

Intermediate: Teams prepare and ask questions about American inventions and their functions. The questions will be written as analogies.

EXAMPLE: The telegraph is to Morse code as _____ is to the telephone.

a. the written word
b. the spoken word
c. a ringing bell
d. the pole

ANSWER: b. the spoken word

Advanced: Teams prepare and ask questions about American inventions and their functions. The questions should be written as riddles.

EXAMPLE: I keep you safe
From thieves at night.
I tell you when you can turn right.
On the tree
I'm a lovely Christmas sight.
So, what am I?

ANSWER: an electric light

(EVALUATION AND BIBLIOGRAPHY ON FOLLOWING PAGE)

EVALUATION

Points Received		Possible Points
____	1. An invention was selected and the problem was defined.	10
____	2. A new invention was created and designed in schematic or written form.	20
	3. A skit was presented which:	
____	• discussed the problem to be solved	10
____	• presented the old invention	10
____	• demonstrated the new invention with a working model	10
____	• discussed the advantages of the new invention.	10
____	4. Debriefing showed understanding of the problem and solution process.	10
____	5. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	6. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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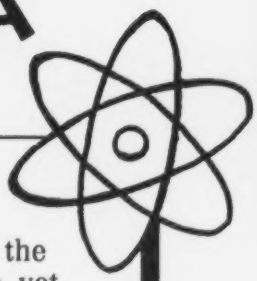
NOTES

Science Problems

ATOMIC CAFETERIA

BY CAROL B. TREMPER WITH JUDITH E. BURR



Introduction

Look. Listen. Taste something. Sniff the air. Feel a surface and think of the many textures in our world. Our senses pick up differences everywhere, yet all this variety is made up of only 103 different ingredients called elements. Elements combine as molecules or compounds to make up every different item in the whole world, from gases to liquids to solids. These same 103 elements make up everything in the universe, even other planets. (Three new elements were discovered between 1969 and 1974, but have not yet been officially named.)

Elements are made of atoms. In the universe, however, some atoms are more common than others. Think of all the atoms in the universe as pennies in a dollar. Of the dollar, $.90 is a single gas, the element hydrogen. Another gas, helium, makes up $.09. All the other elements, 101, count for just the final penny.

Think of your team as a group consisting of an Atomic Chef and puppets in an atomic cafeteria, finding and sharing a molecular recipe for an ordinary compound in a clever, entertaining way. Your audience has to identify your elements and compound from hints your puppets give.

PROBLEM STATEMENT

Demonstrate in a skit some ELEMENTary cooking, choosing elements to combine into molecules of a compound, using puppets and one human performer, the Atomic Chef. Your puppets will present hints to the audience to help them identify the elements and resulting compounds.

DEVELOPMENTAL STEPS

1. Study basic characteristics of atoms, elements, molecules, and compounds.
2. Learn how to recognize a chemical formula, or recipe. Also, become familiar with the letter symbols for common elements listed in the chart below.
3. Review the list of compounds listed below. Select and research one which appeals to you. Find out about the characteristics of the component atoms, as well as the compound.

COMPOUND AND FORMULA LIST

Common Name	Technical Name	Molecular Formula
ammonia (household)	ammonium hydroxide	NH_4OH
baking soda	sodium hydrogen carbonate	$NaHCO_3$
carbon dioxide	carbon dioxide	CO_2
epsom salt	magnesium sulfate crystals	$MgSO_4$-$7H_20$

COMPOUND AND FORMULA LIST (continued)

Common Name	Technical Name	Molecular Formula
limestone & chalk	calcium carbonate	$CaCo_3$
moth balls	naphthalene	$C_{10}H_8$
peroxide	hydrogen peroxide	H_2O_2
plaster of paris	calcium sulfate	$(CaSO_4)_2\,H_2O$
quartz	silicone dioxide	SiO_2
rust	iron oxide	Fe_2O_3
salt (table)	sodium chloride	NaCl
soap	sodium stearate	$C_{17}H_{35}COONa$
sugar	sucrose	$C_{12}H_{22}O_{11}$
vinegar (weak)	acetic acid	$HC_2H_3O_2$
water	hydrogen oxide	H_2O
water glass	sodium silicate	Na_2SiO_3

4. Find out about the art of puppetry and making puppets.
5. Design a puppet show (skit) with one human performer, the Atomic Chef, and a puppet representing each element of the compound selected. During the show, the chef should demonstrate your understanding of atoms, elements, molecules, and compounds.
6. For each element, the puppets should give the audience 4 specific hints: visual, sound, touch (physical object), and riddle. The Atomic Chef should do the same for the compound.

   Example for helium:

   - visual - balloon
   - sound - Donald Duck voice
   - touch - air pump
   - riddle - _____ is to floating, as gold is to valuable.

   The 4 hints per element and compound should be written on a card and given to the judges before your team starts its presentation. Hints may be given by individual puppets, by the group, or any combination.
7. As an extra hint, if necessary, the team should display a student-made Periodic Chart of the Elements with the entire boxes for certain elements blank (no letters, symbols, or number). These are the boxes for the elements in your compound.
8. Decide how your team will add special features to the presentation to make it more colorful, effective, aesthetic, and unique.
9. Practice your puppet show.

PRESENTATION

1. The team has 10 to 15 minutes for set up, presentation, and clean-up.
2. The team should present the card of hints to the judges.
3. The Atomic Chef and puppets should present 4 specific hints for each element and for the compound the team has chosen.
4. After each set of hints, the Atomic Chef should ask someone in the audience to identify the element or compound.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.

2. The team should describe the special (distinguishing) elaboration features included in their presentation.

3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.

4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about common atoms, elements, molecules or compounds, and their "recipes" or formulas.

EXAMPLE: What element puts the taste and smell into garlic and onion?
- a. hydrogen
- b. phosphorus
- c. sulfur
- d. carbon

ANSWER: c. sulfur

Intermediate: Teams prepare and ask questions which apply chemical principles to specific examples of atoms, elements, molecules, and compounds. The questions should be written as analogies.

EXAMPLE: Tarnish is to silver as _____ is to iron.
- a. corrosion
- b. rust
- c. brittleness
- d. blackening

ANSWER: b. rust

Advanced: Teams prepare and ask questions which describe specific compounds. The questions should be written as riddles.

EXAMPLE: I am the universal solvent.
Most of the earth is covered with me.
Human bodies are composed mainly of me.
I am a necessary ingredient for life.
What am I?
- a. water
- b. petroleum
- c. oxygen
- d. ozone

ANSWER: a. water (H_2O)

EVALUATION

Points Received		Possible Points
____	1. Hint card was presented to the judges prior to presentation.	10
____	2. Puppets represented each element and the Atomic Chef represented the compound.	10
____	3. Four hints were given for each element.	20
____	4. The audience guessed the elements.	20
____	5. Four hints were given for the compound.	5
____	6. The audience guessed the compound.	5
____	7. Debriefing showed understanding of the problem and solution process.	10
____	8. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	9. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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FLYING CARPET

BY JUDITH E. BURR AND THEODORE J. GOURLEY

Introduction

In the tales of the **Arabian Nights**, Scheherazade saves her own life and that of the other young women in the kingdom by taking the Sultan on a series of literary adventures. These adventures have been passed down through the ages as some of the most famous folklore of all time.

A common theme running through these stories is magic in words and magic in special objects. One of the magical objects was a flying carpet. Had there really been a flying carpet, Scheherazade might have chosen to save her life by actually taking the Sultan on a trip to strange and mysterious lands.

PROBLEM STATEMENT

Create a functional flying carpet that uses the flow of air to keep it aloft and to control its direction. The flying carpet will carry Scheherazade and the Sultan on an adventure. This adventure may be one of the tales of the **Arabian Nights** retold or a modern adaptation designed by the team.

DEVELOPMENTAL STEPS

1. Learn about the "Principles of Flight" listed below. You might read about model planes and hang gliders, visit a hobby shop or kite store, interview a pilot, visit a museum with displays on flight or fluid mechanics. Particularly notice devices developed to maintain and control flight (such as ailerons). Choose 3 principles you will demonstrate with your flying carpet.

PRINCIPLES OF FLIGHT

lift	thrust
power	angle of attack
directional control	bank and roll
drag	air pressure

2. Review some tales of the Arabian Nights—for example, "The Story of Aladdin," "Ali Baba and the 40 Thieves," "The Story of Sinbad the Sailor."
3. Collect and examine potential materials for your carpet, such as thin wire, straw, balsa wood, plastic, thin cloth, paper, etc. You may need "guide wires" to stabilize your carpet during "flight," just as a kite is stabilized by a string fed by the operator.
4. Consider sources to produce airflow—a portable fan or vacuum cleaner, for example. In what ways might you restrict or direct the airflow to get maximum stability and force?
5. Build your carpet using the Bernoulli effect (lift - increased pressure below and decreased pressure above) and test it. Remember, it must demonstrate the 3 principles of flight. For example: lift could show the carpet rising over a mountain to escape enemies.

6. Write your story in 3 episodes, each one demonstrating a principle of flight with your carpet. Whether you choose to retell an old tale or create a modern adaptation, include the following elements: amazing creatures, exotic lands and people, overcoming incredible odds, the use of wisdom and cunning over treachery and cruelty.
7. Experiment with ways to tell your story. A narrator could speak, actors/actresses could perform each episode, etc.
8. Experiment with scenery and props. How will you show the scenery and props? How will you show the scenery changing behind the suspended carpet as each of the 3 episodes unfolds? Some suggestions are to use a roll of scenery, flip chart, scrim and lights, etc. Be sure to include special features that will make your solution colorful, interesting, and unique.
9. Practice your presentation.

PRESENTATION

1. The team has 10 to 15 minutes total for set-up, presentation, and clean-up props.
2. After the carpet is aloft in front of the scenery, it should demonstrate 3 principles of flight, one for each of the 3 episodes of the adventure story. The team should also act out each episode.
3. One character in the tale should ask the audience to name the principles they see in the presentation.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions on principles of flight.

EXAMPLE: The following describes the shape of an airplane wing:
a. plane
b. baffle
c. wedge
d. airfoil

ANSWER: d. airfoil

Intermediate: Teams prepare and ask questions about the principles of flight and about devices which aid flight. The questions should be written as analogies.

EXAMPLE: The tail is to a bird as the _____ is to an airplane.

a. propeller
b. rudder
c. fuselage
d. engine

ANSWER: b. rudder

Advanced: Teams prepare and ask questions on the principles of flight. The questions should be written as riddles.

EXAMPLE: Up, up, up and away we go.
Why don't we fall? Why don't you know?
We have a vacuum over the wing.
So we can fly like anything.
It's the shape of the wing that makes this work.
With a smooth tilted aileron, with nary a jerk.
Now, name the phenomenon that lifts our flight.
It was used quite nicely by the brothers of Wright.

a. cause and effect
b. Bernoulli effect
c. power
d. airfoil

ANSWER: b. Bernoulli effect

(EVALUATION AND BIBLIOGRAPHY ON FOLLOWING PAGE)

EVALUATION

Points Received		Possible Points
____	1. The presentation included a flying carpet that flies.	10
____	2. The 3 selected principles of flight were demonstrated.	15
____	3. A tale was presented in 3 episodes.	15
	4. The tale included:	
____	• changing scenery	3
____	• amazing creatures	3
____	• exotic lands and people	3
____	• overcoming incredible odds	3
____	• use of wisdom and cunning over treachery and cruelty.	3
____	5. The audience could name the principles of flight demonstrated.	15
____	6. Debriefing showed understanding of the problem and solution process.	10
____	7. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	8. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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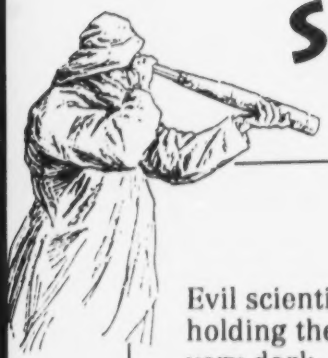
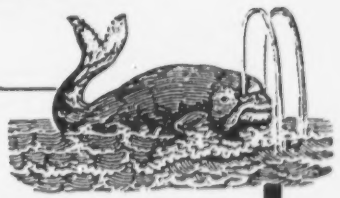
NOTES



SAVE THE WHALES

BY HOWARD HERBERT



Introduction

Evil scientists have captured young whales of different varieties and are holding them in an underwater prison for deadly experiments. The prison is very dark, making it impossible to see the whales. The evil scientists have posted a killer shark in the prison to attack anyone trying to rescue the whales.

Your team of marine biologists are so familiar with the whales that they can identify them by touch. They will save the lives of the whales. The whales could be of the following types: Blue Whale, Narwhale, Sperm Whale, Humpback Whale, or Killer Whale.

PROBLEM STATEMENT

Create a non-verbal communication system which enables teammates to find each whale, identify it by touch, communicate its identity to other team members, and free it. Demonstrate the system in a skit which shows scientists freeing the whales while avoiding the killer shark.

DEVELOPMENTAL STEPS

1. Research the physical characteristics of 5 types of whales. Compare and contrast the size, shape, habits, and other unique characteristics of the whales.
2. Find out about sharks and compare them to whales. How do they compare in size, diet, environment, etc?
3. Select 3 of the 5 whales and make a model of each. The models should be approximately 2' in length, and 6" in diameter, and should emphasize the distinctive characteristics of each type.
4. Make a killer shark. The shark model should be on the same scale as the whale models.
5. Research and discuss non-verbal communication. What system of communicating do whales use? What are some non-verbal communications that humans use? Design a non-verbal communication system for the team to use. This system must enable the team to guide "divers" to whales, while avoiding the shark, and enable the "diver" to communicate the whale identities to the team. This system should be outlined and presented to the judges.
6. Practice identifying the whales by touch, as blindfolded "divers."
7. Practice guiding team "divers" using non-verbal communication.
8. Develop a skit for freeing the whales. In the skit one team member will serve as "captain" and will not be blindfolded. The other team members will be blindfolded "divers." The captain will place the whales and the shark in an "undersea prison," and release one diver to find the whales. The captain will guide the diver with non-verbal communication to a whale, while avoiding the

shark. When the diver finds a whale, he or she will communicate the identity non-verbally to the captain, who will announce the identification and whether or not it is correct. The diver will then come "ashore." The captain will remove the whale if correctly identified, and another team diver will go in. When any divers contact the shark, their turn ends.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. The non-verbal communication system outline should be presented to the judges.
3. One blindfolded team member at a time, the diver, should enter the "undersea prison" area. The captain should give non-verbal signals to direct the diver to avoid the shark and free the whales.
4. Upon reaching a whale, the diver must communicate non-verbally what type of whale is being released.
5. Action continues until all of the whales have been freed or no divers remain.

DEBRIEFING

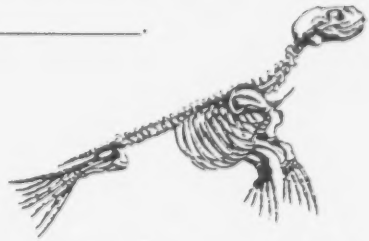
1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about whales and their habitats.

EXAMPLE: A favorite feeding place of whales is the _____.
- a. Mediterranean
- b. Baltic Sea
- c. Grand Banks
- d. Puget Sound

ANSWER: c. Grand Banks



Intermediate: Teams prepare and ask questions about whales and sharks. The questions should be written as analogies.

EXAMPLE: A whale's skeleton is to bone as a shark's skeleton is to _____.
- a. fiber
- b. cartilage
- c. skin
- d. tusk

ANSWER: b. cartilage

Advanced: Teams prepare and ask questions about whales and their undersea environment. The questions should be written as riddles.

EXAMPLE: What is the name that scientists give
To whales who roam the sea?
How like the cowboy's "Don't fence me in,"
Just let me wander free.
What am I?

ANSWER: open sea animal

EVALUATION

Points Received		Possible Points
____	1. The communication system was designed and an outline was presented to the judges.	20
____	2. Three distinguishable models of whales were created.	15
____	3. One shark representation was made.	5
____	4. The divers were able to find and identify the whales.	15
____	5. The divers were able to identify the whales and communicate their identity to the captain.	15
____	6. Debriefing showed understanding of the problem and solution process.	10
____	7. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	8. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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NOTES

JUST HEAVENLY!

BY JUDITH E. BURR

Introduction

As the ship beamed neatly onto its landing pad, Rho snapped off the controls, turned to Xi and enthused, "Well! That was some training session, wasn't it? How'd you like those fantastic eclipses of Betelgeuse (a bright red star 527 light years from Earth, in the constellation Orion) while we were landed on the planet Snood with its 23 moons?"

"They were real nice lunar eclipses," said Xi, tentatively.

Rho wrinkled a silicoid brow. "You mean solar eclipses."

"Uh—oh yes, solar." Xi responded. "I meant that; it's just that I was so dizzy from Snood's revolving that I——"

"Rotating, Xi!" Rho looked crestfallen. "This galactic training course isn't really working for you, is it?"

"No," sighed Xi. "I really want my pilot's license, and I know I just must understand heavenly bodies and their movements to be a good driver. But the systems that we're looking at are so confusing! I can't keep dozens of moons, planets, and suns and what they do to each other straight. After all," Xi continued in self-defense, "I'm only six light-years old, and I've never seen a solar system up close, living my life on this pioneer space station. Couldn't we start with something simpler?"

Rho drummed a crystalloid digit on the control panel. "I see your point. Well, there is one small system about two light-years from here with one planet where you could observe this stuff in a simpler way."

"What's it called?" asked Xi hopefully.

"Earth." Rho flicked on the engines and off they warped.

PROBLEM STATEMENT

Choose an event in the heavens and demonstrate how it occurs in a skit. Team members will themselves be the heavenly bodies.

DEVELOPMENTAL STEPS

1. Research the heavenly bodies and their movement in the solar system. Visit your high school's earth science classroom. Examine models of the solar system; watch videos or films on the topic.
2. Contact your local planetarium; see if you can speak with the staff. Might they demonstrate some of the "heavenly events" with their equipment?

3. Use an almanac to locate upcoming "heavenly events" and find some that you can view with binoculars. Learn how the sun may be safely viewed (*under supervision*).
4. Select one of the "Heavenly Events" below to demonstrate.

HEAVENLY EVENTS

seasons	lunar eclipse
phases of the moon	solar eclipse
rotation and revolution of the Earth	sunrise and sunset
moonrise and moonset	day and night
planetary orbits in the solar system	

5. Plan a demonstration of your "heavenly event." Rather than make a model of it, however, the members of the team will themselves act out the heavenly bodies, demonstrating their movements in a skit. The demonstration is to be given with Earth as the primary reference point. It may, however, include additional bodies of the solar system for clarity, or to show that celestial phenomena are generic to other planets. If, because of limited space, not everything in the demonstration is to scale, a team spokesperson should explain these discrepancies to the audience.
6. Practice organizing your demonstration on a small scale, so each team member knows which path of movement he or she will follow. How will you identify each moving part so the audience can clearly follow your demonstration? How will the moving members be costumed?
7. Experiment with different materials and pr ps to create convincing heavenly bodies; experiment with different light sources for your illuminated bodies or the rays they project.
8. Design a short skit to organize your demonstration. The skit should pick up just after Rho and Xi warp away in their spaceship toward Earth's solar system. What kind of elaboration features can you include?
9. As a driver in training, Xi must report to a review committee (the audience) back in the home galaxy and show a mastery level of learning. In the team's presentation, Xi must show an understanding of the phenomenon just demonstrated by using a two-dimensional format of the team's choosing.

PRESENTATION

1. The team has 10 to 15 minutes for set up, presentation, and clean-up.
2. The celestial occurrence should be presented in a skit using clearly identified team members as parts of the occurrence.
3. A two-dimensional format should show Xi's understanding of the event.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they úsed, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.

4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

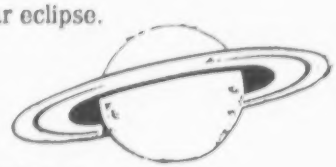
Basic: Teams prepare and ask multiple choice questions about celestial bodies and their movements.

EXAMPLE: When the Earth's axis is tilted toward the sun, we call it _____.
a. winter
b. summer
c. daylight
d. twister

ANSWER: b. summer

Intermediate: Teams prepare and ask questions about the relationship between heavenly bodies and their movements. The questions should be written as analogies.

EXAMPLE: The earth is to lunar eclipse as _____ is to solar eclipse.
a. sun
b. moon
c. earth
d. darkness

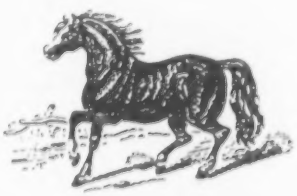


ANSWER: b. moon (Just as the earth comes between the sun and moon to create a lunar eclipse, so the moon comes between the earth and the sun to create a solar eclipse.)

Advanced: Teams prepare and ask questions about the relationship between heavenly bodies and their movements. The questions should be written as riddles.

EXAMPLE: I have a tail, but I'm not a horse.
I have a path, but could go off course.
I must have the sun, 'tho a plant I'm not.
I can be very cold, then again very hot
What am I?

a. meteor
b. plasma trail
c. comet
d. constellation



ANSWER: c. comet

(EVALUATION AND BIBLIOGRAPHY ON FOLLOWING PAGE)

EVALUATION

Points Received		Possible Points
____	1. The team presented a "heavenly event."	20
____	2. The team used their members as the heavenly bodies.	10
____	3. The presentation used the Earth as the primary reference point.	10
____	4. Scale discrepancies were explained.	10
____	5. Props and lighting were used effectively.	10
____	6. Xi demonstrated mastery and presented a two-dimensional explanation to the review board.	10
____	7. Debriefing showed understanding of the problem and solution process.	10
____	8. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	9. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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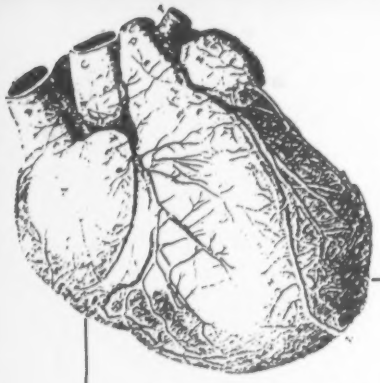


INSIDE OUT

BY JUDITH E. BURR

Introduction

All year long, Jamie has been struggling with the most awful science class ever. Not only is the information hard to understand and the book impossible to read, but the teacher never explains anything! It was bad enough when the class was studying bugs, rocks, and plants—but at least you could *see* them. Now the subject is human body organs and their functions—and how are you supposed to see *them*?

It is the night before the test. Thoroughly confused and exhausted, Jamie drops off to sleep on top of the textbook...and wakes up inside the human body! "Hello there!" says a voice. Jamie jumps to find Hemo, the famous blood cell guide (and now exactly Jamie's size) resting on the side of a vein.

"Perhaps I could be of assistance." Hemo continues, "Now just which organ seems to be causing you the greatest problem?"

PROBLEM STATEMENT

Choose an organ and demonstrate its major components and their functions in a skit. The members of the team will themselves be the components of the organ.

DEVELOPMENTAL STEPS

1. Write for information on or visit "larger than life" exhibits, such as the famous walk-through heart at the Franklin Institute in Philadelphia, Pa. View films which give an "inside view" of living things, for example Nova's **The Incredible Journey**, or the movie **Innerspace**.
2. Use the library and your school's science department to obtain basic books on human organ systems, their structures and functions.

   Note: Two or more **organs** comprise a **system**; do not to try to illustrate an entire system.
3. Choose an organ from the list below and discuss unique ways of transforming team members into its components to actively demonstrate the organ's functions. If you choose a symbolic representation of components and functions, be daring and consider the strong role humor can play.

ORGAN LIST

stomach	eye	tooth
pancreas	ear	bone
small intestine	brain	heart
kidney	tongue	lung
	skin	

4. Design a skit using Jamie, Hemo, and the chosen organ components as characters. Be sure to include colorful, interesting, and aesthetic features to make the solution unique. Use costumes, props, and scenery as appropriate.
5. At least 3 components of the organ chosen must be illustrated (example for the stomach: gastric glands, lining, smooth muscles). At least 3 specific functions of the organ must be actively demonstrated by the components (example for the stomach: entrance of food, chemical breakdown, and exit of food from the stomach).
6. Hemo should guide Jamie through the organ, explaining to the components as they are encountered and the functions as they are demonstrated. This same information should be listed on a 3 x 5 card and handed to the judges before the team's presentation begins.
7. Practice your presentation.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. The team should present the card describing the organ, components, and functions to be demonstrated to the judges.
3. The team should present their skit with Hemo, Jamie, and the organ components.
4. At the end, Hemo should ask the audience to name the organ, components, and functions.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.
3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.
4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

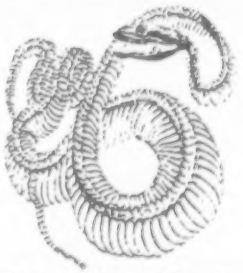
CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about human organs and their functions.

EXAMPLE: _____ cells make up the brain.

a. Fat
b. Bone
c. Nerve
d. Gray

ANSWER: c. Nerve



Intermediate: Teams prepare and ask questions about the relationships of functions to organs. The questions should be written as analogies.

EXAMPLE: Pancreas is to insulin as mouth is to _____.

a. teeth
b. saliva
c. sugar
d. speech

ANSWER: b. saliva

Advanced: Teams prepare and ask questions about specific organs and their functions. The questions should be written as riddles.

EXAMPLE: I make you laugh.
I make you cry.
I make you breathe.
I'll tell you why.
With me you learn all things you can.
And now please tell me what I am!

ANSWER: the brain

EVALUATION

Points Received		Possible Points
____	1. The team provided the judges with a card listing the organ, its 3 components, and 3 functions.	10
____	2. The skit included Hemo, Jamie, and 3 organ components as characters.	25
____	3. Three specific functions of the organ were demonstrated.	15
	4. The audience could name the:	
____	• organ	5
____	• components	6
____	• functions	9
____	5. Debriefing showed understanding of the problem and solution process.	10
____	6. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	7. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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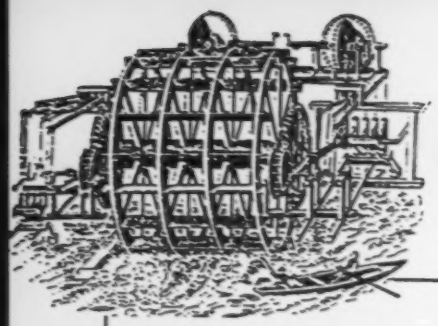


P(H_2O)WER

BY ADELE M. BOURNE

Introduction

Hercules, according to legend the greatest Greek hero and strongest man on earth, was the first known hydraulic engineer. When he had to clean the stables of King Augeas (who had thousands of cattle living in stalls that had not been cleaned for years), he diverted the course of two rivers and cleaned them out in no time.

Archimedes, a Greek philosopher (287-212 B.C.) used water to determine the content of gold in King Hieron's crown. Blaise Pascal, a French mathematician (1623-1662 A.D.), found that water could lift weight. Hydrodynamics, meaning "the motions of water" in Greek, can be harnessed as energy.

Now your team is going to safely contain a radioactive metal using hydrodynamics. In a recent near-tragic accident, given national coverage on the news media, a large amount of highly radioactive metal fell out of its protective casing. As it is naturally too "hot" to be touched safely by humans, it has to be moved hydraulically to a containment area.

PROBLEM STATEMENT

Design waterworks that demonstrates your team's ability to move a gallon of water from one container to another so that half a pound, 8 ounces, of "hot" metal is lifted over a barrier (the edge of the safe containment area). Have a "reporter," who is at the site providing TV coverage, explain the movement of the metal.

DEVELOPMENTAL STEPS

1. Research air and water pressure, the laws of fluid mechanics, and Newton's third law of motion.
2. Research locks, dams, hoses, water mills, and other inventions which harness the force of water.
3. Use at least 3 of the forces listed below to move the radioactive metal. Explain, while the water is being returned to its original container, just what forces were employed and why.

LIST OF FORCES

air pressure	gravity	adhesion
water pressure	cohesion	viscosity
vacuum	displacement	density
friction	surface	buoyancy
turbulence		

4. Design a waterworks to transport the "hot" metal from the container where it was dropped to another, "safe" container.

   - The "hot" metal (approximately 8 ounces) must be transported over a barrier of at least 3 inches above the containers and land intact on the other side in the safe containment area.
   - The liquid and the metal should not be touched directly by hand at any time after the demonstration begins (as, of course, the water is radioactive from contact with the radioactive metal)
   - The base of each container should remain stationary (level) throughout transfer of liquid.

5. Design and practice a skit wherein your waterworks is demonstrated. Have an announcer or reporter explain (on T.V.) each force used to move the metal while it is moving the water. Other people in the presentation might be scientists, guards, etc. Be sure to include special features which will make your presentation colorful, interesting, and unique.

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.

2. A "reporter" should describe the nature of the "accident" that occurred and what is happening as the "metal" is moved over the barrier.

3. A team member should describe the forces that were harnessed in the waterworks.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.

2. The team should describe the special (distinguishing) elaboration features included in their presentation.

3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.

4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions about a mechanism that moves water or uses water to move something else.

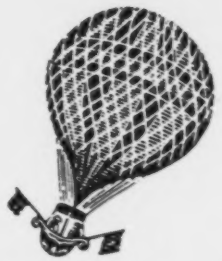
EXAMPLE: The name of a device for lifting water from the hold of a large ship was the _____ Screw.

a. Cartesian
b. Archimedes
c. Rumford
d. Edison

ANSWER: b. Archimedes

Intermediate: Teams prepare and ask questions about the relationship of a machine or device that moves water or uses water to move something else and a machine or device that moves air or is moved by air. The questions should be written as analogies.

EXAMPLE: A coracle is to a frisbee as a submarine is to a _____.
a. 707
b. biplane
c. hot-air balloon
d. barnacle



ANSWER: c. hot-air balloon (a coracle is a small round boat.)

Advanced: Teams prepare and ask questions about the importance, meaning, application, and creation of principles of fluid mechanics. These principles include Archimedes' Law of Floating Bodies, Newton's Third Law, Pascal's Law, Bernoulli's Principle, cohesion, adhesion, and viscosity. The questions should be written as riddles.

EXAMPLE: Water flows through the hose
On a sunny day.
Give the hose a squeeze
For a stinging spray.
Increase the pressure—
Increase the speed.
Who below
Explained this deed?

a. Newton
b. Archimedes
c. Bernoulli
d. Pascal

ANSWER: c. Bernoulli

(EVALUATION AND BIBLIOGRAPHY ON FOLLOWING PAGE)

EVALUATION

Points Received		Possible Points
	1. The waterworks met the design specifications:	
____	• The weight of radioactive metal weighed approximately 8 ounces	10
____	• The metal was transported over the barrier.	10
____	• The containers remained stationary.	10
____	• The liquid and metal were not touched during the transfer process.	10
____	2. The demonstration was set in a skit which described the accident and the transfer process.	15
____	3. The team described principles of fluid mechanics used in their demonstration.	15
____	4. Debriefing showed understanding of the problem and solution process.	10
____	5. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	6. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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WITCHES AND WIZARDS

BY JUDITH E. BURR

Introduction

History is filled with reports of "black" (harmful) magic practiced by witches and wizards. Not only was the magic harmful, but, because no one could determine how it was done, no one could prevent the frightening events attributed to it.

"White" (beneficial) magic has not received as much publicity. For example witches and wizards cured skin boils, reduced fever, eliminated pain, and killed germs to help their clients. Such healers were some of our earliest chemists. They used natural herbs as a basis for their "magic." Interestingly, two of today's most widely used drugs for heart disease and asthma were discovered by these herbal practitioners—digitalis and ephedrine.

You and your team, deeply involved in chemical investigations, have been advanced to the ranks of witches and wizards. While on retreat in the Crystal Cave, perfecting new "white magic" practices to solve mental, emotional, and physical problems, you receive a message that your clients need you back at school. Transported back by extraordinary means, you see them anxiously lined up, awaiting your arrival.

PROBLEM STATEMENT

Solve a client's mental, emotional, or physical problem through the "white magic" of chemistry. The problem should be revealed in a short dramatic scene, and the solution should take the form of an actual chemical demonstration.

DEVELOPMENTAL STEPS

1. Look up the original definitions for "witch" and "wizard" and the terms from which they were derived. How have their meanings changed from the Dark Ages to present day?
2. Study basic chemistry terms and concepts, including the following:
   - matter (the three forms)
   - energy
   - element, mixture, compound
   - physical vs. chemical changes

3. Examine handbooks or activity books for the amateur scientist. These are frequently a source of chemical experiments that are safe, inexpensive, and give visible results quickly. Because of the potential danger inherent in chemical reactions, DO NOT design your own experiment; use one found in your research.

4. Brainstorm possible "client" problems to be solved; select one or more to investigate.
5. Choose a chemical demonstration which can "solve" your client's problem and feature it in a convincing "magical" presentation. The use of any possible hazardous procedures such as open flames, explosions, caustic solids, liquids, or vapors is not allowed.
6. Review the demonstration with your teacher before proceeding.
7. Develop a presentation which includes the following components:
   - a description of the client's problem
   - the appearance or disappearance of something in the presentation through the "magic" of a chemical reaction
   - an explanation of the chemical processes involved in the solution.
8. Describe these components in writing for the judges; if possible, also provide the chemical equation for the reaction.
9. Practice your presentation; appropriate safety procedures must be used.

WHITE MAGIC EXAMPLE

Client's problem:

Jeff is struggling with nightmares that are just terrible! Every night creatures leer at him in the darkness and breathe hot fumes over his bed as he lies there defenseless! No sooner does he jump awake from one dream than he falls back asleep to be attacked by creatures all over again. This is getting exhausting!

The Witches' and Wizards' solution:

Jeff needs an effective guard. A glass bottle partially filled with liquid, over which a package of powder is suspended is designed for him. A deflated balloon is stretched acoss the bottle top.

The first time Jeff jumps awake, he grabs the bottle and tips it so the powder spills into the liquid. Then he rights the bottle and places it back on his bed table. Now the balloon "magically" inflates making a grotesque face appear — Jeff's guard for the rest of the night!

How does it work?

The liquid is diluted acetic acid (vinegar); the powder is sodium bicarbonate (baking soda). The chemical reaction caused by mixing them produces sodium acetate, water, and carbon dioxide gas, which inflates the balloon on which the grotesque face is painted.
The chemical equation is:

$$NaHCO_3 + C_2H_4O_2 \longrightarrow H_2O + CO_2 + NaC_2H_3O_2$$

PRESENTATION

1. The team has 10 to 15 minutes for set-up, presentation, and clean-up.
2. The presentation should include a description of the client's problem, the appearance or disappearance of something, and an explanation of the solution.
3. The judges should be given in written form a description of these components.

DEBRIEFING

1. The team should take a few minutes to describe the procedure they used to create the solution, including resources they used, problems encountered, approaches tried, interesting discoveries, and changes they might make.
2. The team should describe the special (distinguishing) elaboration features included in their presentation.

3. The audience should have a chance to ask questions, tell their reactions, and compare this presentation with others.

4. Judges should provide feedback to the team on strengths of the presentation and areas for further elaboration and development.

CHALLENGE TO THE CLASS

Basic: Teams prepare and ask multiple choice questions that require knowledge of basic elements, compounds, mixtures, and forms of matter.

EXAMPLE: Dry ice is an example of _____ in a solid form.
a. water
b. an element
c. smoke
d. carbon dioxide

ANSWER: d. carbon dioxide

Intermediate: Teams will prepare and ask questions about chemical principles. The questions should be written as analogies.

EXAMPLE: Lemon juice is to acid as Tums is to _____.
a. acid
b. stomach
c. base
d. nausea

ANSWER: c. base

Advanced: Teams prepare and ask questions about the use of chemicals and chemical principles in everyday life. The questions should be written as riddles.

EXAMPLES: I come from the bark of a weeping willow,
But I keep you from weeping with pain.
I am not cold,
But I keep you from staying too hot.
I am dry,
But I keep you from swelling with fluid.
I am inexpensive,
But I've made pharmaceutical companies rich.
What am I?

ANSWER: aspirin

(EVALUATION AND BIBLIOGRAPHY ON FOLLOWING PAGE)

EVALUATION

Points Received		Possible Points
____	1. The problem was presented and described in a dramatic setting.	20
____	2. The problem was solved through the appearance or disappearance of something through a chemical reaction.	20
____	3. The team explained of the chemical process involved in the solution.	30
____	4. Debriefing showed understanding of the problem and solution process.	10
____	5. Challenge questions and answers drew on the content of the problem and appropriate thinking skills.	10
____	6. Bonus for elaboration and creativity.	10
____	**TOTAL**	100

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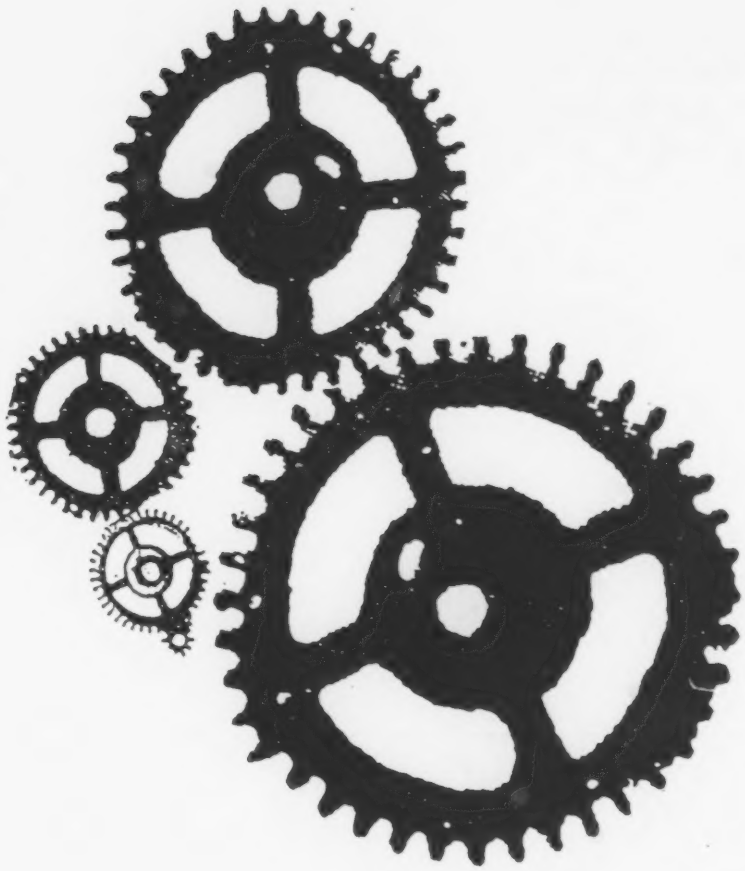
Appendix



APPENDIX

SAMPLE CHALLENGE QUESTIONS

This appendix contains sample challenge questions for 11 Cognetics problems. Not all challenge levels are covered for each project. The questions were developed by students participating in the Cognetics program in New Jersey, and the authors are indicated for each question. Readers are invited to submit new challenge questions, as well as other suggestions, for future editions of Cognetics.*

The questions are presented in the following order:

Inventions/Technology

- Contraption
- Feed Me
- It's In the Mail
- OOO-Ahh-AAA!
- Strike Notice
- Yankee Ingenuity

Science

- Atomic Cafeteria
- Inside Out
- Just Heavenly
- P($H_2$0)ower
- Witches and Wizards

*Send challenge questions or suggestions to: RBS Publications, Research for Better Schools, 444 N. Third St., Philadelphia, PA 19123

CONTRAPTION

A. BASIC LEVEL

1. School: Logan Township Intermediate School
   Author: Shannon Mitchell

   Question: What kind of gear operates a zipper?

   Answer Choices:
   a. worm gear
   b. wedge gear
   c. spur gear
   d. bent gear

   Correct Answer: **b. wedge gear**

B. INTERMEDIATE LEVEL

1. School: East Greenwich Elementary School
   Authors: Chris Taylor, Barbara Basile, Terri Savidge

   Question: Fulcrums are to levers as _____ are to gears.

   Answer Choices:
   a. pulleys
   b. teeth
   c. axles
   d. bases

   Correct Answer: **b. teeth**

2. School: West Paterson, Memorial School
   Authors: Chris DiMartino, Craig Castner, Mike Cannatarro

   Question: The barrel of a gun is to a bullet as a cylinder is to a _____.

   Answer Choices:
   a. piston
   b. sprocket
   c. valve
   d. coil

   Correct Answer: **a. piston**

3. School: William R. Satz School
   Authors: Steven Freeman, Jakob Halpern

Question: Gear is to oil as a ski is to _____.

Answer Choices:
a. snow
b. wax
c. oil
d. lift

Correct Answer: **b. wax**

4. School: Alfred C. MacKinnon Middle School
Authors: Aaron Loomis, Jon Howie, Michael Lorenzo

Question: Handle is to pencil sharpener as _____ is to bicycle.

Answer Choices:
a. chain
b. gear
c. pedal
d. frame

Correct Answer: **c. pedal**

C. ADVANCED LEVEL

1. School: West Essex High School
Authors: Peter Holleuffer, Glen Podaker

Question: Some people call me lazy because I lie on my side all day.
But they don't realize I can decrease the amount of work you have to do. Some people say I act like a wedge, but I tell them I'm not two-faced. What am I?

Answer Choices:
a. wheel and axle
b. pulley
c. inclined plane
d. block and tackle

Correct Answer: **c. inclined plane**

2. School: The Woodlynde School
Author: Joel A. Hurewitz

Question: I am a simple machine that is found on a screw.
If you use a zipper, I am used by you.
I go up, but I also go down.
I am a common item 'cause I'm found all around.
What am I?

Answer Choices: a. pulley
b. lever
c. inclined plane
d. gears

Correct Answer: **c. inclined plane**

3. School: Burlington City High School
Authors: Jasen McConnell, Robert Hopp, Tom Knight, Kristin Stayton, Alicia Mosca

Question: Without them, wheels would roll
Away from your car and into a hole.
Cars usually have only two;
Trucks sometimes have more than a few.
If you break one on a very bad day,
You might as well throw your car away.
What are they?

Answer Choices: a. batteries
b. hubcaps
c. levers
d. axles

Correct Answer: **d. axles**

4. School: Vernon Township High School
Authors: Matt Alaura, Mike Frazer, Jennifer McLaughlin, Yvonne LaForge

Question: I'll get you where you want to go.
Oil will keep me cool as snow.
I have made Detroit my home.
If you use me, anywhere can you roam.
Motion is my key, only vertical not horizontally.
What am I?

Answer Choices: a. gear
b. piston
c. gasket
d. axle

Correct Answer: **b. piston**

5. School: Redding Middle School
Author: Andy Walker

Question: I cut through the water.
I cut through the air.
I slash with sharp blades,

But never make a tear.
I never lose my balance,
Though I spin round and round.
I can push very fast.
Who am I?

Answer Choices:
a. spoke
b. propeller
c. wheel
d. axle

Correct Answer: **b. propeller**

FEED ME

A. BASIC LEVEL

1. School: East Greenwich Elementary School
   Authors: Matthew Fiore, Robin Workman

   Question: A salad scissor is something that you use to _____.

   Answer Choices:
   a. cut up salad
   b. serve salad
   c. cut up the ingredients for a salad
   d. put the dressing on salad

   Correct Answer: **b. serve salad**

2. School: Landis Intermediate School
   Author: Michele Fauver

   Question: A separater is an object that separates the _____.

   Answer Choices:
   a. sugar lumps from the rest of the sugar.
   b. yolk from the white of an egg.
   c. salt from the sugar.
   d. lumps from gray

   Correct Answer: **b. yolk from the white of an egg**

3. School: Dr. William Mennies Elementary School
   Author: Dawn Fedor

   Question: Tongs are used for _____.

   Answer Choices:
   a. shoes in the summer
   b. picking up sizzling hot food
   c. cutting hard to cut foods
   d. wrestling

   Correct Answer: **b. picking up sizzling hot food**

B. INTERMEDIATE LEVEL

1. School: Dennis Township Elementary School
   Author: T.J. Bell

   Question: A pestle and mortar is to Roman times as a _____ is to modern day.

Answer Choices:
a. ricer
b. food processor
c. cheese grater
d. juicer

Correct Answer: **b. food processor**

2. School: Kingsway Regional High School
Authors: Michelle Basile, Jodee Gahrs, Jerome Jackson, Ryan Messick, Katie Moffett

Question: The first knives are to flint as the first spoons are to _____.

Answer Choices:
a. stone
b. wood
c. seashells
d. steel

Correct Answer: **c. seashells**

3. School: Charles Street Sacred Heart School
Authors: Andy Raup, Philip Bradshaw, Tyfanee Pratt, Dawn Guglielmucci, Brandi Adkins, Ashley McAllister

Question: Plastic fork is to medieval wooden knife as paper plate is to _____.

Answer Choices:
a. china plate
b. bread slice
c. wooden board
d. tin cup

Correct Answer: **a. china plate**

4. School: William R. Satz School
Authors: Shyanski Wu, Steven Tow, Stephen Lee, Michael Wang, Alan Ng, Brian Dolan

Question: Chinese are to chopsticks as Polynesians are to _____ .

Answer Choices:
a. spoons
b. forks
c. fingers
d. chopsticks

Correct Answer: **c. fingers**

5. School: Crest Memorial School
   Author: Kirk Blaker

   Question: Neanderthal man is to _____ as modern American man is to fork.

   Answer Choices:
   a. dinosaur teeth
   b. hands
   c. metal tool
   d. tree bark

   Correct Answer: **b. hands**

C. ADVANCED LEVEL

1. School: Warren Hills Regional Junior High School
   Authors: Simon Shapow, David Millard, Jason Meyler, John Riggs

   Question:
   When setting the table, I'm not on the right.
   Although to use me it takes not much might,
   I am good for picking up things.
   I go next to the napkin rings.
   I may look like a devil's spear,
   But I can pick food up without any fear.
   Who am I?

   Answer Choices:
   a. fork
   b. straw
   c. knife
   d. spoon

   Correct Answer: **a. fork**

2. School: Vernon Township High School
   Authors: Leelannee Sloan, John Esteve, Denine Cimmons, Jen Paskey

   Question:
   An ornate vessel without rudder or sail,
   I am moved and emptied by your appetite's gale.
   I hold liquid in, instead of out;
   My body is curved, with a delicate handle and greasy spout.
   My duty is to hold any consistency roux—
   Homemade suspensions or commercial colloids, too.
   What am I?

   Answer Choices:
   a. tea pot
   b. soup tureen
   c. gravy boat
   d. milk pitcher

   Correct Answer: **c. gravy boat**

3. School: Phillipsburg High School
Author: Kelsey Miller

Question: Seasoning foods is my job,
To add taste to corn on the cob.
Tip me over, and just like rain,
Out comes flavor in the form of grains.
What am I?

Answer Choices:
a. stick of butter
b. salt shaker
c. peas
d. peanut butter

Correct Answer: **b. salt shaker**

4. School: South Plainfield High School
Authors: Jason King, Paige Muccilli

Question: I have two parts from a tree.
I'm hard to hold as you can see.
I pick up food from my tips,
But with me you can't take sips.
In the East is where I'm found,
But I've been seen all around.
Who am I?

Answer Choices:
a. chopsticks
b. salad tongs
c. castanets
d. toothpicks

Correct Answer: **a. chopsticks**

5. School: Bordentown Regional High School
Authors: Lauren Blair, Danielle DiCicco, Renaye Jones, Sarah McEwan, Kelly Robinson

Question: I'm low and flat, down near the heat.
In melting butter, the eggs get beat.
Fish can cook and French toast bake.
There are numerous things that I can make.
What am I?

Answer Choices:
a. wok
b. frying pan
c. saucepan
d. casserole dish

Correct Answer: **b. frying pan**

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6. School: Bridgeton High School
Author: Christina Parkhurst

Question: You use me... especially if you are a kid.
Portable ... easy to clean... durable ...
Yet I am not made of silver or steel.
What am I?

Answer Choices:
a. bottle
b. thermos
c. fingers
d. sticks

Correct Answer: **c. fingers**

7. School: Warren Hills Regional Senior High
Authors: Tom Winegar, R.J. Moyer, Nina and Marsha Tsai, D'Ana Reed, Christal Boddy, Gina Santillo

Question: My partner and I will help you to eat
Chinese food or most other treats.
We may be hard for some to use,
But with some practice we can be very fun.
We may drop food, but that does no harm,
The challenge to use us is part of our charm.
We come from traditions from a time in the past,
But our simple design means we'll surely last.
Click us together and large pieces we'll hold;
Smaller food is only for the expert who is bold.
So, with some practice it's easy to see
You'll have hours of fun. Can you guess who
are we?

Answer Choices:
a. tongs
b. chopsticks
c. salad spoons
d. forks

Correct Answer: **b. chopsticks**

IT'S IN THE MAIL

A. BASIC LEVEL

1. School: Rossi School
   Author: George Christianis

   Question: What country had the first public railroads?

   Answer Choices: a. England
   b. Japan
   c. America
   d. Cuba

   Correct Answer: **a. England**

2. School: Crest Memorial School
   Author: Bobby Polis

   Question: The first television set was built in the 1940s.

   Answer Choices: a. True
   b. False

   Correct Answer: **b. False**

3. School: Parsons School
   Authors: Stacey Lacina, Kelly Kish, Kevin Pflug, Stevie Helmeczi, Jason Seigert

   Question: Wiley Post invented the technological device that eventually eliminated the Pony Express.

   Answer Choices: a. True
   b. False

   Correct Answer: **b. False**

4. School: Parsons School
   Authors: Veronica Picone, Lauren Rudders, Michael Dipaolo, Christopher Montville, Dayna Glass

   Question: What machine arranges the letters so they point the same way, and marks the stamps so they cannot be used again?

   Answer Choices: a. stamp canceler
   b. edger-feeder

c. facer-canceler
d. letter LSM

Correct Answer: **c. facer-canceler**

B. INTERMEDIATE LEVEL

1. School: Crest Memorial School
   Author: Jeffrey Gibula

   Question: Egypt is to papyrus as _____ is to clay tablets.

   Answer Choices:
   a. Greece
   b. Mesoamerica
   c. Mesopotamia
   d. China

   Correct Answer: **c. Mesopotamia**

2. School: Memorial School
   Author: John Zollo

   Question: Copper is to electricity as fiber optics is to_____.

   Answer Choices:
   a. heat
   b. light
   c. binary code
   d. sound vibrations

   Correct Answer: **b. light**

3. School: MacFarland Junior School
   Authors: Jim Ardoin, Peter Brown, Scott Hoffman, Warren Horvath, Paul Romberger

   Question: TV is to picture as Morse Code is to _____.

   Answer Choices:
   a. sound
   b. light
   c. message
   d. radio

   Correct Answer: **c. message**

4. School: F. X. Walther School
Authors: Joshua Simon

Question: Samuel Morse is to the telegraph as _____ is to the Pony Express.

Answer Choices:
a. F. X. Aubrey
b. Buffalo Bill Cody
c. Senator William M. Guin
d. Russel, Majors and Waddel

Correct Answer: **a. F. X. Aubrey**

5. School: William R. Satz School
Authors: Lev Kaufman, Bing Feng , Kevin Sachs, Nihal Bhujle

Question: Antenna: soundwaves as _____: mail.

Answer Choices:
a. satellite
b. telephone
c. mailbox
d. camera

Correct Answer: **c. mailbox**

6. School: Ryerson School
Authors: James Tabeek, Tanya Goyal, Stacie Ferralasco, Rachel Crowe, Bree Trufant

Question: _____ is to envelope as wings are to an airplane.

Answer Choices:
a. Letter
b. Return address
c. Stamp
d. Sealing

Correct Answer: **c. Stamp**

C. ADVANCED LEVEL

1. School: South Plainfield High School
Authors: Brian Menyuk, Michael Eng, Michael Weber, Ronald Raynond, Peter Chin, Dorsey Finn, Kevin Riley, Stephen Braynock

Question: I fly through the air at a very high speed.
I can carry a letter, package, or deed
Safely, securely, and quickly indeed.
A hollow cylinder is all that you need.
What am I?

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Answer Choices:
a. pneumatic air tubes
b. satellite
c. space shuttle
d. teleportation

Correct Answer: **a. pneumatic air tubes**

OOO-AHH-AAA!

A. BASIC LEVEL

1. School: Clayton Elementary School
   Authors: Allison Faure, Marie Fisher

   Question: What was the invention that enabled scientists to produce holograms?

   Answer Choices:
   a. synthesizer
   b. halogen lamp
   c. laser
   d. micro chip

   Correct Answer: **c. laser**

B. INTERMEDIATE

1. School: Memorial School
   Author: Jay Rosenberg

   Question: Phonograph is to 1878 as VCR is to _____.

   Answer Choices:
   a. 1982
   b. 1961
   c. 1955
   d. 1978

   Correct Answer: **b. 1961**

C. ADVANCED LEVEL

1. School: Bridgeton High School
   Authors: Andrew Wax, Greg May, Elvin Beardsworth, Leonard O'Mara

   Question:
   I'm not really there, but I'm on the screen.
   I 'm very important, but can't be seen.
   I make editing look crisp and clean.
   I'm used in filming "moving" scenes.
   I can make the illusion of flight
   And then change day into night.
   If you can get this riddle right,
   Then you should feel as high as a kite.

   Answer Choices:
   a. animation
   b. split screen

c. blue screen effect
d. dissolve

Correct Answer: **b. split screen**

2. School: South Plainfield High School
Authors: M. Kordelski, S. Sarao, T. Donnelly, B. Menyuk, A. Garbarini, K. Kalyka, E. Shepp, D. Gallo

Question: I give the film added depth.
My main colors are red and blue.
I look blurry with the naked eye;
But with this special gear,
The images on the screen appear ever so near.
What am I?

Answer Choices: a. Dolby sound
b. 3-D glasses
c. holograph
d. technicolor

Correct Answer: **b. 3-D glasses**

3. School: Burlington City High School
Authors: Jim Baer, Allison Brotz, Tony Clark, Bob Coppola, Christine Craig, Mike Dold, Jaenn Jo

Question: I am the heart of film-making.
I can defy time.
Without me, confusion and lack of continuity may reign.
Even though the industry has changed drastically,
I am the same as from the beginning.
What am I?

Answer Choices: a. editing
b. special effects
c. creativity
d. directing

Correct Answer: **a. editing**

A. BASIC LEVEL

1. School: Clayton Elementary School
   Authors: Rachel Cromley, Alison Leon

   Question: Changing the tempo of a song may also change the _____.

   Answer Choices:
   a. scale
   b. mood
   c. melody
   d. tone

   Correct Answer: **b. mood**

2. School: New Albany School
   Authors: Darren Bacon, Christie Burns

   Question: If you tap a row of glasses filled with different water levels, the pitch of the one with the most water will be _____.

   Answer Choices:
   a. loudest
   b. highest
   c. lowest
   d. softest

   Correct Answer: **c. lowest**

3. School: New Albany School
   Author: Katy Kelly

   Question: If you combine the sound of two instruments into one, what must change?

   Answer Choices:
   a. pitch
   b. timbre
   c. volume
   d. none of the above

   Correct Answer: **b. timbre**

B. INTERMEDIATE LEVEL

1. School: Crest Memorial School
   Author: Liz Vogel

   Question: Theme is to music as _____ is to art and literature.

   Answer Choices:
   a. motivation
   b. motif
   c. medium
   d. none of the above

   Correct Answer: **b. motif**

2. School: Valley Middle School
   Authors: Kristen Russo, Jennifer Smith, Holly Schulze, Alice Rentz

   Question: Light and shadow are to balance in art as piano and _____ are to balance in music.

   Answer Choices:
   a. guitar
   b. crescendo
   c. forte
   d. tempo

   Correct Answer: **c. forte**

3. School: Valley Middle School
   Authors: Jessica Zitcer, Jennifer Dickover, Erin Song

   Question: Imagery is to mood in poetry as _____ is to mood in music.

   Answer Choices:
   a. meter
   b. phrasing
   c. violin
   d. tone

   Correct Answer: **b. phrasing**

4. School: Dennis Township Elementary School
   Author: T.J. Bell

   Question: Rumba is to a rhythm in music as _____ is to a rhythm in poetry.

   Answer Choices:
   a. iambic
   b. verse
   c. sonnet
   d. stanza

   Correct Answer: **a. iambic**

C. ADVANCED LEVEL

1. School: Burlington City High School
   Author: Philip Powers

   Question: You'll find me in a bird
   Humming a beautiful song.
   You'll hear me in a dog
   Talking all day long.

   Look to a howling wind,
   Or to a hungry knife
   To find what writers and poets
   Use to show simulated life.
   What am I?

   Answer Choices:
   a. hyperbole
   b. gratification
   c. personification
   d. alliteration

   Correct Answer: **c. personification**

2. School: Warren Hills Regional Junior High
   Authors: D'Ana Reed, Robert Moyer, Jeremy Joblon, Mike Smith

   Question: At times I confuse; I'm difficult to construct; I hold a message. I contain a set of seventeen syllables which may be unique. I am a type of ancient Oriental art that shows emotions. What am I?

   Answer Choices:
   a. Tonka
   b. Lyric
   c. Blank verse
   d. Haiku

   Correct Answer: **d. Haiku**

3. School: Burlington City High School
   Authors: Jen Gitto, Kristian Kauker, Heather McConnell

   Question: I float through the air,
   But I cannot be seen.
   Though I may take a rest,
   I'll come right back.
   Don't call me flat,
   Though I might be blue,
   But not all the time.
   You should be able to guess me by now.
   What am I?

Answer Choices:
a. rhythm
b. pollen
c. melody
d. cloud

Correct Answer: c. melody

4. School: South Plainfield High School
Authors: Sophomore Cognetics Team

Question: My voice is played with fractions
I am written as flags and sterns.
I can be syncopation,
Or the counting of a band.
I am the drum that plays ta-tum-tum.
I am the heart beating lub-dub, lub-dub.
Do you know who I am?

Answer Choices:
a. balance
b. rhythm
c. tone
d. sound

Correct Answer: b. rhythm

YANKEE INGENUITY

A. BASIC LEVEL

1. School: Joyce Kilmer School
   Authors: Colin Fahey, John Rigsby, Scott Levine

   Question: Alfred Nobel created this to destroy buildings and make space for new things. What did he invent?

   Answer Choices:
   a. wrecking crane
   b. dynamite
   c. bulldozers
   d. shovel

   Correct Answer: **b. dynamite**

2. School: Logan Township Intermediate School
   Authors: Gregory Davis, Zamani Ma'ruf, Nick Stokolosa

   Question: The Indian name for barbed wire was _____.

   Answer Choices:
   a. killing wire
   b. sharp-toothed fence
   c. devil's rope
   d. cutting whip

   Correct Answer: **c. devil's rope**

B. INTERMEDIATE LEVEL

1. School: Kingsway Regional Jr. High School
   Authors: Kim Massinino, Gerry Micheal, Chezarae Rose, Shannon Verdieck

   Question: Car is to car-bra as ice cream is to _____ .

   Answer Choices:
   a. cookie wafer
   b. dish
   c. spoon
   d. chocolate syrup

   Correct Answer: **a. cookie wafer**

2. School: Leonard V. Moore School
   Authors: Rahim Alexander, Paula Vey, April Bauknight, Michelle Miller, Matthew Myers, Lynette Canady, Stacey Naused

Question: Jonas Stalk is to the polio vaccine as _____ is to the measles vaccine.

Answer Choices:
a. William Measles
b. Donald E. Wahlberg
c. Albert Einstein
d. John F. Enders

Correct Answer: **d. John F. Enders**

3. School: MacFarland Junior School
Authors: Shannon Lucas, Jennifer Nuel, Jaymee Romero, Sajani Shah, Dawn Sittinger

Question: Lightbulb is to lamp as needle is to _____.

Answer Choices:
a. syringe
b. pin cushion
c. sewing machine
d. haystack

Correct Answer: **c. sewing machine**

4. School: Buckingham Friends School
Authors: Jaime Ginsberg, Linnea Bradford, Blayne Wright, David Cohen, Kee Wrigley, Mark Wisse

Question: Horse is to saddle as bicycle is to _____.

Answer Choices:
a. bench
b. seat
c. chair
d. wheel

Correct Answer: **b. seat**

5. School: Herma S. Simmons School
Authors: Gillian Keys, Doug Bastow

Question: Airplane is to travel as _____ is to industry.

Answer Choices:
a. assembly line
b. steel
c. chemicals
d. cement

Answer: **a. assembly line**

C. ADVANCED LEVEL

1. School: Bordentown Regional High School
   Authors: Brian Applegate, Brian Guire, David McDermott, Brian Shestko, Joe Turak

   Question: You commit a sin—
   I'll shred your skin.
   Climb over me—
   I'll cut you in three.
   I could make your life end;
   I'm a guard's best friend.
   What am I?

   Answer Choices:
   a. pickett fence
   b. barbed wire fence
   c. chainlink fence
   d. none of the above

   Correct Answer: **b. barbed wire fence**

2. School: Rahway High School
   Authors: Chris Hardy, Janice Francis, Jeff Twaskas, Jennifer Canales, Ryan Alexander

   Question: I keep you dry all day and night;
   I protect you from an ugly sight.
   I come in colors, but mostly white,
   And I won't leak, if I fit tight.
   What am I?

   Answer Choices:
   a. raincoat
   b. bottle cap
   c. goggles
   d. disposable diaper

   Correct Answer: **d. disposable diaper**

ATOMIC CAFETERIA

A. BASIC LEVEL

1. School: Logan Township School
   Authors: Rae Heritage, Lesha Chaifetz, Shannon McCarthy, Gregory Beckett, Frank Cahill

   Question: What is the tiniest part of an element that can exist and still have the properties of that element?

   Answer Choices:
   a. molecule
   b. atom
   c. electron
   d. none of the above

   Correct Answer: **b. atom**

2. School: Shongum School
   Authors: Eric Gould, Chris Johnson, Eric Miller, Seth Shran, Jonathan White, Sunny Wong, Jack Levy, Becky Carlson

   Question: How many electrons are in a helium atom?

   Answer Choices:
   a. 40
   b. 10
   c. 2
   d. none of the above

   Correct Answer: **c. 2**

3. School: Merchantville School
   Authors: Rachel Levin, Sarah Skorupsky, Kristi Tropp

   Question: Atomic number tells how many _____ are in the _____.

   Answer Choices:
   a. protons - nucleus
   b. nuclei - electron
   c. neutrons - molecule
   d. electrons - nucleus

   Correct Answer: **a. protons - nucleus**

B. INTERMEDIATE LEVEL

1. School: Ryerson School
   Authors: Drew Helmholtz, Susy Davidson, Rob Walker, Kevin Toth

   Question: Oxygen is to human as carbon dioxide is to _____.

   Answer Choices:
   a. non-living matter
   b. plant
   c. animal
   d. water

   Correct Answer: **b. plant**

2. School: Kingston School
   Authors: Stacy Goldberg, Priti Panchal, Melissa Majikes, Jennifer Parroco

   Question: Red litmus paper is to baking soda as blue litmus paper is to _____.

   Answer Choices:
   a. bleach
   b. ammonia
   c. soda ash
   d. orange juice

   Correct Answer: **d. orange juice**

3. School: Judd Elementary School
   Author: David Schwanke

   Question: Proton is to positive charge as electron is to _____ charge.

   Answer Choices:
   a. battery
   b. neutral
   c. negative
   d. any

   Correct Answer: **c. negative**

4. School: The Academy, Wayne
   Authors: Craig McLauchlan, Josh Lowy, Jonathan Eisenstein, Eric Binder, Allen Yuhas, Les McCord

   Question: Calcium is to gypsum as _____ is to matches.

   Answer Choices:
   a. sulfur
   b. phosphorus

c. sodium
d. ash

Correct Answer: **a. sulfur**

C. ADVANCED LEVEL

1. School: Warren Hills Senior High
   Author: Ingrid Steiner

   Question: I burn in the air to form a pungent, colorless gas. I serve as an antiseptic, fungus-killer, a preservative for dried fruits. I am necessary in the manufacturing of wood pulp for paper. If I am combined with oxygen and water, I form what is perhaps the most versatile and useful acid known to people. What am I?

   Answer Choices:
   a. calcium carbonate
   b. sulphur dioxide
   c. ferric oxide
   d. potassium nitrate

   Correct Answer: **b. sulphur dioxide**

2. School: Bordentown Regional High School
   Authors: S. Borgstrom, B. Stahl, P. Looney, J. Diamond, P. Patel, C. Czarnecki, J. Toth

   Question: I am found in households throughout the world.
   I am very precious in some areas.
   I can be in the form of bars.
   I can make you shine.
   What am I?

   Answer Choices:
   a. soap
   b. baking soda
   c. gold
   d. ammonia

   Correct Answer: **a. soap**

3. School: Joyce Kilmer School
   Authors: Erik Boe, Jill Chiandusse, Drew Feust, Kate Hedman, Kristina Henkler, Rachel Layton, Erika Ravettine, Kristie Tippner

   Question: I'm a compound all shiny and transparent. I have six sides and when I'm perfect. I have a point. Who am I?

Answer Choices: a. O_2Si
b. SiO
c. Si_2O
d. H_2O

Correct Answer: b. SiO

5. School: Fernbrook School
Authors: Joseph Ferraro, Adam Doll, Tom Dolack, Brian Rothbart, Samir Shah

Question: My technical name is naphthalene; my molecular formula is 10 parts carbon and 8 parts hydrogen. What am I?

Answer Choices: a. epsom salt
b. peroxide
c. rust
d. moth balls

Correct Answer: d. moth balls

A. BASIC LEVEL

1. School: Joyce Kilmer School
   Author: Paul Hedman

   Question: How long does it take for food to digest?

   Answer Choices:
   a. 24 hours
   b. 2-5 hours
   c. 5-7 hours
   d. overnight

   Correct Answer: **b. 2-5 hours**

2. School: Joyce Kilmer School
   Author: Katie Williams

   Question: The pupil of the eye _____ when there is a lot of light.

   Answer Choices:
   a. becomes larger
   b. stays the same
   c. becomes smaller
   d. none of the above

   Correct Answer: **c. becomes smaller**

3. School: Clara Barton School
   Authors: Matthew Ryan, Christopher Bennett

   Question: What releases gastric juices in the stomach?

   Answer Choices:
   a. gastric juice door
   b. small intestine
   c. digestive glands
   d. liver

   Correct Answer: **c. digestive glands**

4. School: Clayton Elementary School
   Author: Ryan Cogan

   Question: Semi-circular canals in this organ give you balance.

   Answer Choices:
   a. bones
   b. liver

c. kidney
d. ear

Correct Answer: **d. ear**

5. School: New Albany School
   Author: Allan Polak

   Question: Which part of the brain produces the watery liquid called cerebro-spinal fluid?

   Answer Choices:
   a. choroid plexus
   b. dendrites
   c. capillaries
   d. crevices

   Correct Answer: **a. choroid plexus**

B. INTERMEDIATE

1. School: West Paterson Memorial School
   Authors: Holly Berdan, Stephanie Lucas

   Question: The heart is to circulation as the duodenum is to _____.

   Answer Choices:
   a. excretion
   b. breathing
   c. digestion
   d. reproduction

   Correct Answer: **c. digestion**

2. School: Ocean City Intermediate School
   Author: Alison Hooper

   Question: The bronchi are to the lung as the papilla are to the _____.

   Answer Choices:
   a. stomach
   b. brain
   c. ear
   d. tongue

   Correct Answer: **d. tongue**

3. School: Charles Street School
Authors: Kelly Dickinson, Deanna Rush, Matthew Monohan, Jodie Bartello, Jenna Marotta, Randy Johannsen, Steven Huston.

Question: Money is manufactured in a mint as the color in the eye is manufactured in the _____.

Answer Choices:
a. iris
b. pupil
c. cones
d. retina

Correct Answer: **c. cones**

4. School: West Deptford Middle School
Authors: Lisa Hill, Michelle Wall, Jamie Crawford

Question: Pyloric valve is to stomach as bicuspid valve is to _____ .

Answer Choices:
a. mouth
b. lungs
c. ears
d. heart

Correct Answer: **d. heart**

5. School: Crest Memorial School
Author: Mike Rago

Question: Right brain is to Harry Anderson as left brain is to _____.

Answer Choices
a. Dan Rather
b. Pee Wee Herman
c. Steve Martin
d. Alf

Correct Answer: **a. Dan Rather**

C. ADVANCED

1. School: Warren Hills Regional High School
Authors: Thomas Lawrence, Mike McGovern, Karen Snyder, Stephanie Miller, Ingrid Steiner, Marcia Tsai, Crystal Boddy

Question: My first is in bunny and also in bear.
My second's in heart and also in care.
My third on this paper is easily found.
My fourth is in king, but never in crown.

My fifth is in thank, but not in forgive.
My whole helps you breathe, eat, sleep, and live.
What am I?

Answer Choices:
a. National Wildlife Federation
b. brain
c. lungs
d. senseless riddle

Correct Answer: **b. brain**

2. School: Burlington City High School
Authors: Cognetics Team

Question:
I am an organ long and wide.
I'm in your mouth from side to side.
I can help you chew hour by hour.
Thanks to me you taste bitter, salty, sweet, and sour.
You know me well, but I'll help you guess.
Say the alphabet and stop at "S".
Without me you'd be a mime.
I help with that letter all the time.
What am I?

Answer Choices:
a. teeth
b. gums
c. tonsils
d. tongue

Correct Answer: **d. tongue**

3. School: South Plainfield High School
Authors: Freshman Cognetics Team

Question:
Without me you can't stand up straight.
I let you know when you must wait.
I pick up the dropping of a pin.
I'm not alone; I have a twin.
Many tools are inside of me,
My function is not easy to see.
I get pierced from time to time,
And I'm amused by a silly rhyme.
What am I?

Answer Choices:
a. ear
b. brain
c. eye
d. leg

Correct Answer: **a. ear**

4. School: Bordentown Regional High School
Authors: Brian Shestko, Brian Applegate, David McDermott, Brian Guire, Joe Turak

Question: I have a hammer, a stirrup too.
My drum picks up things said by you.
My anvil does not do much —
This part is for hearing, not for touch.
These are the things inside of me;
Now tell me please what can I be.

Answer Choices:
a. inner ear or labyrinth
b. middle ear
c. ear canal or meatus
d. hearing organ or organ of corte

Correct Answer: **b. middle ear**

5. School: Bordentown Regional High School
Authors: Scott Borgstorm, Craig Czarnecki, Jim Toth, Brian Stahl

Question: I move out; I move in.
I'm not connected to the chin.
You can see me, but you can't see past.
When the light goes on, I move very fast.
Could I be a, b, c, or d?
That is all the hints you'll get from me.
Who am I?

Answer Choices:
a. iris
b. cornea
c. pupil
d. retina

Correct Answer: **b. cornea**

JUST HEAVENLY!

A. BASIC LEVEL

1. School: Kellman Academy
   Authors: Neil Steinberg, Jon Adler, Michael Benn, Jaime Herndon, Shira Perlis, Michelle Rosenberg, Joselle Zand

   Question: What kind of eclipse occurs in the moon's penumbra?

   Answer Choices:
   a. partial
   b. total
   c. annular
   d. phase

   Correct Answer: **a. partial**

2. School: Madison Public Schools
   Author: Anne Gepford

   Question: The path the Earth takes around the Sun is called its _____.

   Answer Choices:
   a. rotation
   b. axis
   c. orbit
   d. equator

   Correct Answer: **c. orbit**

3. School: Ocean City Intermediate School
   Author: Holly Palermo

   Question: The greatest speed of the earth's rotation is perihelion, as the least (slowest) speed of the earth's rotation is _____.

   Answer Choices:
   a. hypohelion
   b. taphelion
   c. aphelion
   d. ergohelion

   Correct Answer: **c. aphelion**

B. INTERMEDIATE LEVEL

1. School: Franklin School
   Author: Palak Pandya

   Question: Ganymede is to Jupiter as _____ is to Saturn.

   Answer Choices:
   a. Phobos
   b. Titan
   c. Leda
   d. none of the above

   Correct Answer: **b. Titan**

2. School: Martin J. Ryerson School
   Authors: Sara Gardner, Shannon Ackermann

   Question: A starting line is the beginning of a race as the _____ is the beginning of spring.

   Answer Choices:
   a. vernal equinox
   b. blooming of flowers
   c. astronomical starting
   d. autumnal equinox

   Correct Answer: **a. vernal equinox**

3. School: Kingsway Regional High School
   Authors: Matthew Borzio, Michael James, Randy Hurst, Michael Cononica, Robert Kunkle, Ryan Lawler, Kate Fredericks

   Question: _____ is to Venus as 1.0 is to Earth.

   Answer Choices:
   a. .76
   b. .91
   c. .39
   d. 1.19

   Correct Answer: **b. .91**

A. BASIC LEVEL

1. School: Center Grove School
   Authors: Jeff Magnani, Tim Kaywork, Meredith O'Marra, Seema Desai

   Question: The first water wheel was used mainly to _____.

   Answer Choices:
   a. make electricity
   b. grind grain
   c. power steam engines
   d. make steam

   Correct Answer: **b. grind grain**

2. School: Merchanvtille School
   Authors: Patrick Brennan, Matthew Gilliss

   Question: Archimedes' Screw moves water from one place to another by _____.

   Answer Choices:
   a. vacuum
   b. turbulence
   c. water pressure
   d. turning blades

   Correct Answer: **d. turning blades**

3. School: Center Grove School
   Authors: David Kolibaba, Michael Weissman, Brian Stuelpner, Eric Rosenthal, David Lyon, Linnea Schiffner, April Coss

   Question: The first water-powered plant for generating electricity was built in what state?

   Answer Choices:
   a. Washington
   b. New York
   c. Wisconsin
   d. Wyoming

   Correct Answer: **c. Wisconsin**

B. INTERMEDIATE LEVEL

1. School: Ocean City Intermediate School
   Authors: Jason Hooper, Crystal Styers, Cathy Lavelle, Kasey Kiser

   Question: NASA's vertical axis generator is to St. Malo as wind is to _____.

   Answer Choices:
   a. geothermal
   b. tides
   c. nuclear fission
   d. nuclear fusion

   Correct Answer: **b. tides**

2. School: Kingston School
   Authors: John Potter, D. J. Marcucci, Matt Dunn, John Kontovrakis

   Question: Hot water is to dishes as _____ is to carpet.

   Answer Choices:
   a. dirt
   b. vacuum cleaner
   c. creme rinse
   d. fiber

   Correct Answer: **b. vacuum cleaner**

3. School: Valley Middle School
   Author: Chris Winberry

   Question: Water pressure is to water closet as air pressure is to _____.

   Answer Choices:
   a. airplane
   b. hot air balloon
   c. vacuum cleaner
   d. fan

   Correct Answer: **c. vacuum cleaner**

4. School: Chapel Hill School
   Author: Chris Porter

   Question: Windmill is to wind as _____ is to water currents.

   Answer Choices:
   a. anemometer
   b. hydroturbine
   c. water pump
   d. hydraulic pump

Correct Answer: **b. hydroturbine**

C. ADVANCED LEVEL

1. School: Bridgeton High School
   Authors: Greg May, Elvin Beardsworth, David McAllister, Brandon O'Mara

   Question: While eating Wheaties, Archimedes saw how they did float.
   He added a few more; the milk ran on the floor and he yelled this famous quote...

   Answer Choices:
   a. Oh, Gosh!
   b. Eureka!
   c. Wowee!
   d. Gnarly Dude!

   Correct Answer: **b. Eureka!**

2. School: Burlington City High School
   Authors: Philip Power

   Question: Many, many years ago,
   Although I could not float in air,
   I proved, if placed in the water flow,
   Some of my weight would seem to disappear,
   With an equivalent space that would displace
   As I rose to the surface at a steady pace.
   Who am I?

   Answer Choices:
   a. Newton
   b. Archimedes
   c. Pascal
   d. Bernoulli

   Correct Answer: **b. Archimedes**

3. School: Woodlynde School
   Authors: Paul W. Brundage

   Question: I wrote "Les Provinciales;"
   I am a Frenchman by name.
   I am a physicist by career,
   Physics and math, all the same!
   My teacher was Desargues, you see.
   My father was named Etienne.
   My mother died before my prime;
   My sister, a literary gem.
   I believed in H_20, as a claim;

Lifting mass is it's trait.
Look it up in the "Traite Du Vuide,"
Who am I? Tell me, I can't wait!

Answer Choices:
a. Frederic Joliet
b. Henri Becquerel
c. Blaise Pascal
d. Jean Foucault

Correct Answer: **c. Blaise Pascal**

A. BASIC LEVEL

1. School: Aaron Decker Elementary School
   Authors: Michael Dudzak, Andrew Glinka, Theresa J. Scott, David Saus

   Question: Sand and iron filings together are an example of a _____.

   Answer Choices:
   a. chemical change
   b. mixture
   c. compound
   d. physical change

   Correct Answer: **b. mixture**

2. School: Frank Antonides School
   Authors: Michael Heayn, Andrew Ilvento

   Question: What is the symbol for copper?

   Answer Choices:
   a. C
   b. Co
   c. Cu
   d. Fe

   Correct Answer: **c. Cu**

3. School: Aaron Decker Elementary School
   Authors: Christine Bilello, Erin Capriel, Alyssa Dominianni, Alison Gulino, Matthew Harden, Kara Kroll, Daniel Madine

   Question: Alchemy was an early form of chemistry. It was a practice that combined _____.

   Answer Choices:
   a. science, religion, and magic
   b. science and nature
   c. science, art, and mathematics
   d. mathematics and art

   Correct Answer: **a. science, religion, and magic**

4. School: Merchantville School
   Authors: Tom Olchon, Josiah Van Sciver, Emily Wood, Brian Yan

   Question: Rust is an example of _____.

Answer Choices: a. H_2O
b. $FeCl_2$
c. $NaHCO_3$
d. Fe_2O_3

Correct Answer: **d. Fe_2O_3**

B. INTERMEDIATE LEVEL

1. School: A. C. Redshaw School
Authors: David Thomas, Shandon Scott

Question: Salad dressing is to emulsion as seawater is to _____.

Answer Choices: a. colloid
b. solution
c. suspension
d. immiscible

Correct Answer: **b. solution**

2. School: West Paterson Memorial School
Authors: Michele McGarrity, Tara Hunt, Michael Rubino

Question: Chromium is to green as cobalt is to _____.

Answer Choices: a. red
b. blue
c. yellow
d. white

Correct Answer: **b. blue**

3. School: Franklin School
Author: Danielle Ransom

Question: NaCl is to sodium chloride as KOH is to _____.

Answer Choices: a. carbonic acid
b. ammonium hydroxide
c. potassium hydroxide
d. acetic acid

Correct Answer: **c. potassium hydroxide**

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